THE AUSTRALIAN AND NEW ZEALAND JOURNAL OF SURGERY

VOLUME XX — 1950-1951

Under the Direction of the Editorial Committee of the Royal Australasian College of Surgeons

Chairman: E. S. J. KING.

Prof. F. GORDON BELL (N.Z.).
L. A. BENNETT (N.Z.).
A. E. BROWN (Vic.)
Sir HUGH CAIRNS (Eng.)
F. J. CLARK (W.A.)
V. M. COPPLESON (N.S.W.)
F. J. COLAHAN (Vic.)
Prof. H. R. DEW (N.S.W.)
Sir THOMAS DUNHILL (Eng.)
M. S. S. EARLAM (N.S.W.)
P. STANLEY FOSTER (N.Z.)
ROBERT FOWLER (Vic.)
D. J. GLISSAN (N.S.W.)
GARNET HALLORAN (N.S.W.)
R. V. HENNESSY (Vic.)
Sir CHARLES HERCUS (N.Z.)
Sir VICTOR HURLEY (Vic.)
J. A. JENKINS (N.Z.)
I. B. JOSE (S.A.)
KEITH KIRKLAND (N.S.W.)
ARTHUR JOYCE (Vic.)
V. J. KINSELLA (N.S.W.)
L. E. Le SOUEF (W.A.)
L. C. E. LINDON (S.A.)
J. A. MacFARLANE (Canada)
J. S. MacMAHON (N.S.W.)
Prof. P. MacCALLUM (Vic.)
F. A. MAGUIRE (N.S.W.)
Prof. B. T. MAYES (N.S.W.)
DONALD McKENZIE (N.Z.)
DOUGLAS MILLER (N.S.W.)
R. A. MONEY (N.S.W.)
HENRY MORTENSEN (Vic.)
J. B. G. MUIR (Tas.)
Sir HENRY NEWLAND (S.A.)
F. W. NIESCHE (N.S.W.)
MILROY PAUL (Ceylon)
H. R. G. POATE (N.S.W.)
BALCOMBE QUICK (Vic.)
C. A. M. RENOU (Vic.)
DOUGLAS ROBB (N.Z.)
Sir CARRICK ROBERTSON (N.Z.)
Prof. LAMBERT C. ROGERS (Wales)
Prof. C. F. M. SAINT (South Africa)
HENRY SEARBY (Vic.).
JULIAN SMITH (Vic.).
K. W. STARR (N.S.W.)
G. G. L. STENING (N.S.W.)
Prof. S. SUNDERLAND (Vic.)
M. P. SUSMAN (N.S.W.)
NEVILLE G. SUTTON (Q.)
BRIAN SWIFT (S.A.)
H. C. TRUMBLE (Vic.)

Editor: K. F. RUSSELL.

Secretary: H. G. WHEELER.

Editorial Communications:
SECRETARY,
Royal Australasian College of Surgeons,
Spring Street, Melbourne.

Business Managers:
A. H. MASSINA & CO. PTY. LTD.
350 Swanston Street, Melbourne.

ANNUAL SUBSCRIPTION, £2 2s. 0d.

SINGLE NUMBERS, 10s. 6d.

33595

CONTENTS

VOLUME XX — 1950-51

AUGUST, 1950.

The George Adlington Syme Oration: Medicine and the Humanities	*Sir John Medley*	1
Cerebral Angiography in Neurosurgery	*J. L. Dowling*	
Part I. The Angiographic Appearances in Cerebral Tumours		11
Part II. The Angiographic Appearances in Intracranial Aneurysms		20
Gas Cysts of the Intestine	*E. S. J. King*	25
The Treatment of Traumatic Ulnar Neuritis	*T. King*	33
Ocular Palsies Associated with General Diseases	*T. Keith Lyle*	43
Hypospadias	*K. B. Fraser*	52
Surgery of the Inferior Oblique at its Scleral Insertion	*C. S. Colvin*	59
The Treatment of Carcinoma of the Breast	*V. M. Coppleson*	65
The Operation for Undescended Testes in the Superficial Inguinal Pouch	*C. Craig*	69
Four Unusual Complications of Partial Gastrectomy	*J. P. Fleming and J. N. Ward-McQuaid*	73
Books Reviewed		79
Books Received		84
Correction		84

NOVEMBER, 1950.

The Relative Merits of Various Suture Materials for the Repair of Severed Nerves	*Professor S. Sunderland and G. K. Smith*	85
Malignant Disease of the Thyroid	*Hugh R. G. Poate*	114
The Genesis of Varicose Veins	*E. S. J. King*	126
Some Problems in Oesophageal Surgery	*Douglas Robb*	134
Modern Approach to Developmental Abnormalities	*Ida Mann*	142
Transplantation of Ureters into the Colon	*Grayton Brown*	151
Editorial: Surgical Judgement	*Sir Hugh Devine*	161
Books Reviewed		162
Book Received		164

THE AUSTRALIAN AND NEW ZEALAND JOURNAL OF SURGERY.

FEBRUARY, 1951.

Indications for Pulmonary Resection	*O. Theron Clagett*	165
Megalocornea and its Surgical Complications	*J. Bruce Hamilton*	184
The Management of Carcinoma of the Prostate	*K. L. H. Kirkland*	188
The Inversion Operation in Femoral Hernia	*C. Craig*	195
Advances in Cardio-Vascular Surgery	*O. Theron Clagett*	201
Marion's Disease or Bladder Neck Stenosis	*E. Musard Nanson*	215
Pancreatic Tissue in the Wall of the Small Intestine	*J. H. Ogilvy*	224
Desmoid Tumour of the Abdominal Wall	*G. H. Burnell*	232
Gumma of the Lung	*M. P. Susman*	235
Delayed Splenic Haemorrhage—A Clinical Study	*J. T. Hueston*	238
Books Reviewed		242
Books Received		244

MAY, 1951.

Technique of Gastrectomy	*Leo Doyle*	245
Squamous Epithelium in Encysted Hydrocele of the Cord	*E. S. J. King*	265
Observations on the Surgical Anatomy of the Thoraco-Lumbar Sympathetic System	*K. C. Bradley*	272
Sequelae of Treatment of Hydatid Cysts of the Lung	*S. C. Fitzpatrick*	278
Technical Aspects of the Surgery of Hypertension with a Follow-up of Fifty Cases	*Douglas Miller*	285
Diaphragmatic Deformation of the Liver	*G. S. Christie*	289
Complicated Case of Otitic Cerebral Abscess	*R. S. Hooper*	304
Interinnomino-Abdominal Operation	*Milroy Paul*	311
Seminoma in the Ectopic Testis	*V. S. Howarth*	313
Books Reviewed		315
Books Received		318

1

The Australian and New Zealand
JOURNAL OF SURGERY

Vol. XX — No. 1 AUGUST, 1950

THE GEORGE ADLINGTON SYME ORATION

MEDICINE AND THE HUMANITIES.

By Sir John Medley.
Melbourne.

I SUPPOSE that the only operation for the performance of which I could reasonably be regarded as an adequate substitute for a distinguished surgeon is the delivery of an oration, and I am indeed honoured that you should have called upon me to fill the regrettable gap created by the enforced absence of Sir Reginald Watson-Jones, the more so as I have been the Syme orator on a previous occasion. I thank you very sincerely but must at once introduce a note of more than usually heartfelt deprecation. I am, it is true, less ignorant than I was—the effluxion of time enables even the least intelligent to erect in front of him a facade of what will pass for knowledge—and much experience has modified the fears which used to assault me when confronted by a professional audience. But I am still a layman—a mere administrator—and I confess to an unconquerable diffidence at the prospect of addressing you tonight, the B.M.A. in Brisbane in ten days' time and an audience in Melbourne in October as the Stawell orator. I should feel happier if there were not an obligation—a very proper one, of course—to publish orations, for that does handicap the unscrupulous, and if the preparation of a worthy discourse did not involve strength of will, peace of mind and leisure. The passage of time has a habit of eroding the first and the other two are strangers to the vocabulary of a Vice-Chancellor. I can only hope that what I have succeeded in evolving may be adjudged not altogether unworthy of the occasion and of the distinguished surgeon in whose memory we are gathered here this evening.

I met Syme only once a short time after I first came to Australia and I do not remember anything that he said to me. It is likely that this is because he said nothing for he was, I believe, the most laconic and unrhetorical of men and there was no reason for him to take any particular interest in a youthful stranger. Both parties to this unremarkable encounter would have been profoundly incredulous had any future relationship, other than a possibly professional one, been suggested. He, I suspect, would have thought it odd that an oration should commemorate his silences and I would certainly have found it difficult indeed to envisage any turn of events that could twice translate me to the role of his commemorator. But I am somewhat comforted by the feeling that he would probably have approved of the title of my discourse—"Medicine and the Humanities." I must leave it to your judgment as to whether that approval would have extended to its contents.

It is perhaps natural that I should choose to discourse on the humanities for as far as my own education is concerned I was nurtured on little else but them in the narrowest definition of the word. There is, in my house, a silver salver which was presented to Dr. Franck Bright, my wife's grandfather, by the boys of the Modern Side at Marlborough, of which he was the first organiser and master. It stands next to a bronze—I mention this for local colour only—which was presented by a grateful patient to his father—the Bright who has achieved immortality by naming a disease. The date on the salver is 1872 and it is less than a

century ago that the English public schools began to realise that an exclusive diet of the classics was not enough to provide an education in tune with the needs of a modern community. But the fight was long and bitter and no real solution has yet been reached. I was myself brought up in one of the last strongholds of the old regime. I was taught no science and little history or mathematics, and I emerged from the University just in time for the first World War, magnificently unprepared for the rude realities of life. There are those—and perhaps I was one of them—whose minds can flourish adequately in an ivory tower. But they are a minority—a minority much too small for the needs of our contemporary life — and during the last half century the educational world has been indulging in paroxysms of experiment often, I think, rather half-hearted, designed to counteract the irresistible drive towards narrow specialisms which the demands of material progress have imposed. As must always happen under such circumstances it has been very difficult to see the wood for the trees and to pick the right path between the ferociously competing theories of those who would abandon the whole corpus of the old system, which after all, was not incapable of producing first-rate people, and those who believe that educational development should move slowly even though the world for which it provides preparation is accelerating daily. I am, myself, a gradualist—as you would expect from my training —though with some leanings towards occasional action, but I have certain strong views and one of them is that the greatest surviving barnacle of the old regime is the theory that some subjects are cultural whilst others are not. English, I understand, is cultural, particularly Shakespeare: mathematics are not, especially Newton. A language other than your own (whether or no you are articulate in the latter) is cultural, especially if it is dead. Science is not — under any circumstances. What nonsense it all is! The theory is, to some extent, a reflection of the fact that teachers vary in capacity and that we have not gone out of our way to attract into the most important of all professions an adequate number of men and women capable of arousing the right kind of appetite in their pupils. But at bottom it reflects an unwillingness to leave the old and well-tried formulae for the exciting and difficult business of distilling a new culture out of a new and exciting world. What, after all, is Culture? I do not mean by it, as has often been meant in the past, the precious possession of a minority: still less do I mean a superficial veneer lacquered upon enormous numbers of unwilling victims. I mean by it what happens when men and women who have spent their formative years in the study of a curriculum reasonably relevant to the world actually around them go out into it with a background for the appreciation of its problems in their proper perspective and with such appetite for the less material things of life as their individual capacity is capable of achieving. Let me conjure up before you three pictures — a young Elizabethan, nurtured on tales of adventure in an expanding world, roaring at Falstaff amongst the groundlings: a young Whig aristocrat of the 18th century, nurtured on the classics and the authorised version of the Bible, reading Terence in his noble library and talking like a scholar even at the gaming table: a young Australian of the year of our Lord 1950, nurtured on Hollywood, Mandrake and the radio, struggling with his notes on Macbeth for a public examination. A culture, aggressive and alive: a culture, narrowed and static, it is true, but still relevant to the spirit of a leisurely age: a culture, at best fighting a dispirited rearguard action against emotional bankruptcy, at worst nothing, bombinating in a vacuum. There are still people who will tell you that a study of Intermediate Latin is necessary to salvation: some of my medical friends assure me that without it you cannot possibly approach the portals of Aesculapius — who was, of course, a Greek. If you ask why, they tell you firstly that it provides an impalpable something that enables you to write English better — in which case it is curious that only a small percentage of those who matriculate can, in fact, use their own language in a reasonably coherent and workmanlike manner — and secondly, that without it the inner meaning of such well-known Latin roots as pneumonia, empyema and rheumatoid arthritis cannot possibly be appreciated — an odd passport, one would have thought, to a life primarily devoted to problems of correct diagnosis. I spent too much of my early life translating good English into bad Latin and worse Greek, and the older I become the more bitterly do

I regret the irreplaceable gaps which have been left in my intellectual equipment as a result. I am tired of hearing about "impalpables" in education. A scientific world, just because it is scientific, is not thereby debarred from what are sometimes patronizingly called "higher things" by the intelligentsia and it is not a betrayal of those higher things to its demands if we ask that the results of any educational process shall be measurable within a reasonable margin of error. To insist on impalpables is the hallmark of a culture on the defensive — which is exactly what the contemporary world must avoid like the plague. The ideas we have to combat can only be defeated by intellectual aggression on every front.

My plea then is for a reasonable relevance, for a curriculum which will face the fact that it tends to be dominated by outmoded educational values and that there is an overwhelming cultural value in relevance to the times per se. Until this fact is faced and very real changes made as a result we cannot expect to see flourishing the proper child of relevance which is tolerance — tolerance towards the cultural experiments which must precede the flowering of any new order fully worthy of the name. If you educate for the 18th century in the 20th, you are producing an unnatural combination which can have little chance of healthy survival and will, like the chimera, spend much of its time very uncomfortably with its head contemplating its tail in a spirit of incredulous and sometimes active disapproval. I find it difficult myself to gain pleasure from modern poetry or to view with any degree of appreciation the enigmatic writhings of the Contemporary Art Society—indeed it would be with very real apprehension that I should submit to the anatomical explorations of a surgeon whom I knew to be an impassioned admirer of Dali or Picasso. But I am—and I know I am —a "pagan suckled in a creed" which, if not outworn, is at all events in need of refreshment from contemporary sources, and I believe that it is my business to do what I can to help those whose vision of our— at this moment exceptionally transitory — world may be more instructed than my own. That is why I ask for more relevance in our curricula. Without it we are condemned to wallow in a morass that may well engulf us, and if our successors have any sense of the fitness of things they will see to it that the inscription on our tombstone is incorrectly written in Intermediate Latin.

This diatribe is largely a quotation—which I gratefully acknowledge — from a lecture which I gave in Melbourne some six years ago at a time when some of us had real hopes that the great opportunities afforded by reconstruction after the war would be seized with both hands. For various reasons those hopes have been imperfectly fulfilled and one is tempted to ask whether, in fact, those of us who really believe, as opposed to those who only say that they do, that the Humanities are not useless lumber as part of an educational system are not barking up the wrong tree and would perform a more useful function by turning their attention to more practical matters. There are two ways of answering the question. One—too often adopted by educators—is to summon the spirits of poets and philosophers from the vasty deep, ascend with them to the stratosphere and go on saying the same things as have been said too often and to no effect before. The other is to come down to earth, stay there and take some definite contemporary starting point from the consideration of which it can reasonably be expected that a satisfactory answer can be obtained. My starting point to-night is provided by your profession and you will, I hope, look kindly on the inevitable ignorance of a layman who is as convinced as any of you of the enormous importance of its flourishing in the fullest possible way, and who believes that the moment is opportune for directing attention to certain basic considerations which concern you not only professionally but as members of the community at large.

My thesis is tripartite and its first two headings need little elaboration or emphasis. They are, that under contemporary circumstances, the learned professions have an importance, ethical, political and social, which they have never before attained and that the medical profession in particular cannot rise to the height of the times unless some reconciliation can be reached between the demands of your technological diehards and the imperative demands (for that is what they are from the community standpoint) of the still small voice of the Humanities. My third point is that the solution of the

problem can only be sought in the upper reaches of our educational system — and upon that I am perhaps more qualified to speak as a partial expert than on the others, which will be a comfort to me when I reach it, if not to you. Let me first, however, do my best with the essential preliminaries.

The main problem confronting democratic societies at the present stage of their development in the modern world is that of evolving a doctrine as to the social mingling of liberty and compulsion in the close-knit fabric of the contemporary scene. I have no definite solution for it but I suspect that the degree of freedom which is practically possible must bear a close relationship to the extent to which there is a wide distribution of institutions founded upon professional qualifications and standards and the extent to which those institutions use the freedom which must be theirs if they are to do their community jobs with wisdom and restraint. Ancient civilisations were dominated by Crafts — avocations based on customary activities and modified by the trial and error of individual practice. Modern societies tend to group themselves to an ever increasing degree into professions — avocations whose activities are subjected to theoretical analysis and are modified by theoretical conclusions derived from that analysis. The practice of a profession cannot be disjoined from its theoretical understanding. The distinction between craft and profession is not, of course, absolute any more than is the distinction so often and so blithely drawn, particularly in university circles, between fundamental and applied research. But the growth of the general body of knowledge, which is clearly the dominating factor in the development of professional groups, makes the distinction a very real one and inevitably places in the hands of those who possess that knowledge a degree of power for use or misuse which has introduced a new factor into the modern social scene. I need not remind you of the way in which non-democratic societies have used and are using that power to further their own particular conceptions and of the danger to any liberty worth the name which must result from the ignoble perversion of knowledge to such ends. In the middle ages there was only one learned profession—the Church—and for long periods the power that is derived from knowledge was concentrated in her hands. To-day that power is largely in the hands of a group of learned professions, of those who supervise the standards of individual professional competence and of professional practice. The problem of freedom comes in here—I am quoting now from an essay of Whitehead's, by whose views I have been profoundly influenced. "Professional organisations," he writes, "do not censure opinions so much as learning and ability. In the more important fields of thought, opinion is free and so are large divergencies of practice. The community is provided with objective information as to the sort of weight which can be attached to individuals and as to the sort of freedom of action which can safely be granted. Whatever is done can be subjected to the test of professional opinion, acting through the network of institutions which has evolved to meet the needs of the times. Moreover, this sort of development allows large freedom to be extended to non-professional individuals inasmuch as the great professional institutions, as long as they are efficient, should be able to demonstrate the dangers of extravagant notions. In this way, where sudden action is not in question and there is time available for the deliberate weighing of the issues involved, reason has obtained an entrenchment which should be impregnable. Indeed, individual freedom, standing apart from organisations, has now its indispensable role. For all organisations are liable to decay and licence for outside criticism is the best safeguard for the professions."

To this basic view of the contemporary importance of the professions I add two further points. As must always happen in times of great social upheaval these are days of uncertain and fluctuating moral standards. A wide gap has been opened between those of us—now, alas! verging on the senile — whose intellectual and moral foundations were laid in a world which we foolishly supposed to be reasonably stable and those who have spent their lives in

"wandering between two worlds, one dead
The other powerless to be born."

The Churches, for all their striving, have not yet succeeded in providing a satisfactory refuge for the doubts and difficulties of the

generality of the younger generation and the unquestioning certainties of their forefathers make little appeal. Under such circumstances the presence in the community of bodies of individuals who are bound together to observe and who have the power to enforce rigid standards of ethical practice, who put the pursuit of quality above all questions of self-interest and who are given freedom within the law of the land to run their own affairs as seems good to them—such a spectacle to-day has double its ordinary social value and any serious erosion of its integrity would be a disaster of the first magnitude. The extent to which a modern democracy can flourish as such depends upon the extent to which its professions retain and make proper use of their freedom.

My other point is of a different character. Efforts to mitigate the pernicious growth of insensate nationalism seem to many of us, however convinced we may be of their urgency, to be unrealistic and the brave new world to be retreating from us as rapidly as any of the extra-galactic nebulae. I admit that optimism is difficult but to refuse such comforts as there are is a counsel of despair. In mediaeval times and later a stratum of international understanding—admittedly of a tenuous character — was provided by the members of the fighting and land-owning aristocracy who treated each other in war as companions in a rather dangerous sporting event and in peacetime as representatives of interests, the preservation of which overrode the comparatively minor business of individual states. Any reader of 17th and 18th century travel memoirs will recognise my point which remains valid down to the days of Thackeray and Lever in the 19th century. That stratum has now been repeopled by the scientists and it is mainly due to the organisation of the profession that this has come about. Knowledge is of its essence international and the greater its body grows the greater is the area of international understanding on the highest plane which becomes available. It is not my task to-night to discuss the misuses of this power with which we are all too familiar. I say only that it is the business of the professions to do their utmost to marshal reasonable opinion behind them, to seize every opportunity of promoting that international liaison at their particular level which the virtual annihilation of the handicaps imposed by distance has made so possible, and above all not to raise panic-stricken umbrellas when the climate of unreasonable public feeling becomes adverse. We are—and I can speak as a member of the despised though essential profession of administrator — the ambassadors of Reason, and not only in our own communities, and it behoves us never to forget it.

It is not my business to draw invidious distinctions between the professions—indeed it would be suicidal for me to do so in view of my connections with most of them. But I am speaking to an audience which is largely of one particular colour—I use the word in a professional and not a political sense — and I am bold to say that in the light of the foregoing your calling has a very special importance in the world to-day. It is a plain fact that your work brings you into contact with a larger number of ordinary people than that of any other profession. Many a man goes to his grave without ever having had direct contact with a lawyer, an engineer or, nowadays, a clergyman. The teacher's influence is too often transitory and it is the worst advertisement of our educational system that so large a percentage of its victims greet its ending with a glee which they make no attempt to disguise. But none of us can escape contact with the medical man. He starts us off, he ushers us out, and in between these major events he has a multiplicity of contacts with most of us which can, and often do, exercise a profound influence extending much further than the mere sustaining of our physical well-being. It would be impertinent to stress this point to you save as the preface of my principal thesis which is that if I am right in suggesting that the professions are the touchstone of a healthy democratic life and that the part played by your profession in the whole process is of transcendent importance to it something more than a mere technological equipment is utterly necessary for your members. Your province extends far beyond the textbook requirements of formal qualifications to practise and, though it is difficult to avoid those stratospheric generalities so beloved by educators in any discussion of this sort, I want, in the time that remains to me, to put into communicable form certain

thoughts that have been constantly in my mind during my experience of this last twelve years of university work.

I have said that the professions should be the ambassadors of reason. The outward manifestations of reason can be defined as a liberal attitude towards life — the antithesis of that narrow specialism which can see no virtue in anything that does not immediately affect it and often very little in that. The foundations of such an attitude can only be laid in the formative years of education and it is an attitude, a state of mind, not a course of three lectures a week throughout the academic year. It is not primarily a product of the classroom but a combination of the less palpable influences exerted by the teacher as a person and through that by the mutual reactions of the taught upon each other — the last being a factor the importance of which is often overlooked. The liberal attitude, in fact, needs a certain leisure if it is to flower, a certain occasional remoteness from the presence of utilitarian things—and it is precisely these conditions that a university in theory exists to supply. I know of no better definition of its purposes than that propounded by that great teacher and philosopher — the late Professor Alexander of Manchester. "I should define a university," he wrote, "as an association or corporation of scholars and teachers engaged in acquiring communicating or advancing knowledge, pursuing in a liberal spirit the various sciences which are a preparation for the professions or higher occupations of life. I had almost said that the purpose of a university was to prepare for the professions and I should be ready to defend this provided that the words in a liberal spirit are not merely not omitted but emphasised. Without such emphasis it is safer to say not that its purpose or object is the professions which may appear too utilitarian but that it does, in fact, prepare for the professions by pursuing the sciences on which they are founded." Whitehead said the same thing more shortly when he remarked that the purpose of a university is to inspire learning with imagination.

Now it is notorious — though not so irrefutable a fact as some of our more drastic critics would have us believe—that the redbrick university of to-day does not supply the conditions of reasonable freedom from the cares of this world which are necessary for the production of the liberal spirit in quantities adequate for our needs. It is not surprising that this should be so. Universities began in mediaeval times when schools of theology, law and medicine came together because their members needed more than the technical learning which those schools as individual units could supply. The profound social changes of the Renaissance period made the mediaeval university out of date and in the early 19th century, under von Humbolt's influence, Germany produced a new type of university which profoundly influenced academic development everywhere. To-day the stresses and strains of the democratic and technological revolutions are again enforcing upon us inevitable changes which must be squarely faced unless universities are to become merely beautiful barnacles on the body politic. There is no Platonic ideal of a university to which it must conform or die. We are integral parts of the living social system and we must supply its needs or go the way of all institutions which refuse to adapt themselves to their environment.

Now those needs which have crowded upon us with ever increasing momentum and urgency over the last half century have inevitably brought in their train a degree of specialisation which we all unceasingly lament—some of us less half-heartedly than others. The result of it is that the liberal spirit is in danger of malnutrition to vanishing point and we might just as well face that fact. Culture itself—to judge from the majority of contemporary manifestations — has become as esoteric an affair as nuclear physics and, liberal as I try to be myself in these matters, I can see little chance of a synthesis emerging from the present climate of frustration which could serve as a real breeding ground for the more gracious and less technological accompaniments which have been a feature of the great civilisations of the past. There is, it is true, one alleviating factor which, in the long run, may have a greater influence than in moments of depression one is apt to envisage. It is no longer necessary to "do Arts" in order to gain some acquaintance with the best of the achievements of the past in cultural fields. Such phenomena as the Penguin and Pelican

books and the praiseworthy but sometimes misguided efforts of radio to flood the home with music and information do have as their result that numbers of engineering and even medical students are at least as likely to enjoy Brahms and Beethoven as their more formally instructed colleagues on the Arts side. To that extent the world is a better place than it was in my youth. But this is merely nibbling at the fringes of the problem of preserving the liberal spirit, which cannot obtain adequate nourishment from crumbs which may fall from the air. It must emerge as an inescapable residue from the educational process.

I have been speaking of the liberal spirit rather than of the Humanities and it is time that I linked the spirit with the letters — litterae humaniores being, as you doubtless know, the title of that Oxford course which probably represents the Humanities in their finest flowering as an educational medium. I did so because I wanted to emphasise that it is a spirit, an attitude and not a mere corpus of information that we have to produce. I am not suggesting—as you will have gathered from my earlier remarks — that Latin and Greek or even another modern language are necessary passports to the acquisition of a liberal mind. They are good media if really well taught, if really imaginatively taught—but that happens very seldom in Australia. Still less am I suggesting that a surgeon who can quote Shakespeare or discuss Cezanne is automatically a better member of his profession than his colleague whose non-professional reading is restricted to the green covers of the Penguin series and who prefers his pictures in glorious technicolour. Human tastes are infinitely variable and I have the profoundest suspicion of any formula that would seek to equate real virtue with formal culture. I mean by the Humanities as an educational factor the kind of education that will produce the virtue of humanity in the widest sense of that beautiful word. You often bewail to me the decay of the qualities which made up the old-time general practitioner and there is no better illustration of what I am trying to convey. I remember—it is not very relevant but 'twill serve—an old gentleman who looked after us as children and once some 55 years ago—after several much more distinguished specialists had failed—extracted from some inconvenient crevice in my tracheotomised larynx a boot button which I had swallowed in an inadvertent moment. Years afterwards when I went back to Oxford as an undergraduate, I visited him, a very old man in retirement. As soon as he knew who I was, he put his finger into his waistcoat pocket, drew out the button and said, "I've never been so proud of anything as of that." He would not, I think, have been regarded very favourably nowadays—he kept, I remember, a large and very unclean monkey on a perch in his consulting room and he was not unlike the monkey himself. He had little Latin and less Greek; his professional knowledge was years out of date. But I saw much of him in his old age: he was the wisest man I ever knew and for most practical purposes the best physician. I hope his rotund ghost is listening to me to-night.

I need not elaborate—you all know better than I what I am driving at. But when one leaves generalities and looks at the facts of our educational system, how can we set about improving matters? Are the universities struggling hard enough against the demands of specialism, hard enough to produce any effective counter to the alarming increase in the community demand for narrow minds? It is tempting to answer with an unconditional negative. But there is great encouragement to be derived from the undoubted fact that our graduates can and do hold their own in any company as persons as well as technologists and that the reputation of our universities in foreign centres of learning has never been higher. We cannot be wholly bad. But I am far from complacent about it. We are fortunate in our raw material—the finest, as I believe, in the world—and that alone should spur us on to do better by it than at present. From a practical standpoint, in what direction should we go?

I spoke earlier of the importance of courses relevant to contemporary needs. I do not mean by this that we should abandon the study of the past and rely upon civics, economics, general science and the contemplation of current events to provide us with humane education. Far from it. The essence of such an education is that it should provide a framework of reference as an approach to the good as opposed to the merely economic

life and a foundation for the development of those qualities which can make man at his best only a little lower than the angels. Such a framework and such foundations can only be laid down by linking the past with the present in a way that will rouse imagination and the appetite for more, and the picture will clearly be incomplete unless there be included in it some study of the ways in which mankind has reacted to the need for beauty and spiritual comfort as well as for knowledge and for daily bread. In the old days the picture was adequately created for a small minority by way of Latin and Greek — studied to the exclusion of almost all else from early youth and taught by scholars who were often capable of using the bare bones of language to open magic casements on to an extraordinarily wide range of history, politics and aesthetics. But such are not common in Australia—or anywhere else nowadays—and many considerations lead to the view that the formal part of a modern humane education can only consist of a limited number of general courses, varying in breadth and depth, but capable of being taught to large numbers and of providing that common background or framework of reference which we all know to be an at present unrealised educational essential. I do not propose to embark upon the vexed question of what should be taught in them or how they should be taught. One is always referred to the four year college courses of the United States in this connection. It must be remembered in any such discussion that those courses were the foundation of the American system of higher education and that they long preceded the grafting on to them of what we should call universities ' which have only developed during the last fifty years. There is considerable uneasiness about many aspects of them nowadays and I, myself, am doubtful about the wisdom of such a frontal attack upon culture as they represent. In any case I can see no possibility of introducing into our system of tertiary education an innovation which could only result in a substantial lengthening of university courses and a serious postponement of the average age of entry into the earning arena.

But some introduction of general courses there has got to be and if agreement could be reached upon their duration and content rather less than half of the real problem would be solved. The rest of it centres round the conditions under which they are to be given, where, when and how, the essential objective being to provide the possibility of those informal contacts without which the kind of education I am seeking is certain to degenerate into the production of large numbers of persons who insist on asking questions but refuse to listen to the answers. Is there any solution which is not impracticable?

I remember saying to you five years ago that the University—I was referring to Melbourne — saw no reason for contemplating substantial changes in its pattern. I am not so sure now in the face of my increasing realisation of the urgency of what I have been saying to you to-night. We in Melbourne—I cannot, of course, speak for others —have been trying very hard over the last few years to integrate our different disciplines on their margins, to persuade arts teachers to maintain active contacts with the science schools and engineers to believe that an attitude of cynical detachment is not the only way of regarding medicine. We have had a measure of success, thanks to the enthusiasm of certain members of our staff, but under present conditions possibilities are very limited and only a small number of students can be appreciably affected. That applies in particular to the medical school which is, in fact, a university school only in name after the third year of the course and before that tends to maintain a certain isolation produced by the pressure of technological requirements. Something much more drastic must be attempted if real results are to be achieved in face of the large numbers we must expect at universities in the future.

Briefly the solution must lie along the lines of a period of compulsory residence for all students who desire to obtain the highest professional qualifications in a college, hostel, hall of residence—call it what you will — situated preferably not in a metropolitan area. The period which need

not be more than one year — it would be unreal under Australian conditions to try for more—would be a prerequisite for entry to the technological years of every professional course. It could include some part of the fundamental studies directly applicable to the course involved, but it is my belief that these need not bulk very largely in it if in medicine, for example. the question of how much formal chemistry and physics is really necessary for the course was realistically faced and the possibility fully explored of handing most of the resulting residue over to the schools. The time is over-ripe for an overhaul of the content of many courses — though it will need a dictator of a phenomenally brutal type to achieve the necessary results. Somehow at any rate time must be found during one year only for the provision of a modicum of that leisure to which I referred earlier, of a common or very largely common basis of general courses and of the physical conditions which are necessary for the creation of a liberal spirit. I believe that this cannot be done within our present university pattern—or at best only done so imperfectly that we should not pretend to be satisfied with its possibilities. I know, of course, that much good work is done in existing colleges. But their numbers are too small to have more than a local effect and what they do could only gain in effectiveness if not only their own students but the great majority of all students had had some experience of that kind of community life.

That this kind of community life does do what we want is a point accepted by most educators and I need not labour it. I have, moreover, some practical experience to support the particular pattern I am suggesting. The Melbourne University Mildura Branch has now — to my great regret — ceased to exist, but its three years' life was sufficient to give ample proof of its potential efficacy as a nursery of humanity. We were forced to abandon it for reasons that constituted no criticism of its educational value. In the absence of any possibility of a general compulsion on students to go there, numbers fell off as the immediate postwar pressures decreased to an extent which ceased to justify continuance of large expenditure. Mildura itself was rather too isolated and too far away to be the ideal site for such an experiment, which must, to be wholly successful, involve the possibility of frequent contacts with other centres. And, lastly, the large numbers of part-time students—which my own university, rightly to my thinking, encourages in all faculties save medicine, dentistry and engineering—does, under present economic circumstances make any general decentralisation programme impossible. But I supported the abandonment of the Branch with the greatest reluctance and only after eighteen months' continuous struggle to find means of retaining it. It did its particular job extraordinarily well — thanks to the people who ran it. But it did more than that. We did our best to provide Mildura students with the cultural amenities of a genuinely residential university. There was some leisure there undisturbed by the too potent attractions of a metropolis. There was a chance of withdrawal from the hurly burly of controversy and of enjoying membership of a community small enough to be reasonably coherent. Do not misunderstand me. I make no claim that we created a temporary Oxford in the irrigation area. But the facts are that those who have come from Mildura to Melbourne are clamouring for a continuance of the kind of extra-curricular activity we were able to organise there and that they are having a very real effect upon the general spirit of the University. I am much mistaken if it will not be found when they come to graduate that their standard of humanity is higher than the average and that your profession will reap appreciable benefits from their entry to it.

I am certain that the right solution to our problem must lie along these lines. I know, of course, that there will be numerous lions in the path. Money? Well, to cope with increasing needs and numbers all universities must carry out enormous building programmes in the next twenty years. My suggestion would provide some relief for overcrowded city sites and, in the long run, total costs might not be much greater than those which would be involved in exclusively

metropolitan development. Time? An increase of one year in courses would be necessary but the specialists will insist upon that anyhow unless their rivals anticipate them and compel them to undertake the difficult but imperative task of overhauling existing courses in a realistic manner. Part-time students? Their needs must be catered for by a separate institution and their numbers may well decrease if the principle of Government assistance for higher education is largely extended, as the coming Federal scholarship scheme seems to envisage. Content of new course? I leave that to the experts, merely remarking that I am convinced that it is possible to devise a course of one year which, given the right physical environment, might set an example to the educational world.

I am conscious that I have said too little about the medical profession and not enough about the Humanities to justify the title of my discourse. But it is my business to deal in generalities and however hard I try to keep them in their proper place they will come creeping in. If you conclude that what I have said is too impractical, I can only reply that I see no other solution of a problem which concerns all of us who believe that the golden age of the learned professions is still to come. I should like to have taken a hand in working the solution out. But I must leave that to younger men and comfort myself by hoping that our Mildura vintage will make so irresistible an appeal to the connoisseur that our experiment will be regarded in the future as a really important landmark in Australian educational development.

I conclude by thanking you again for honouring me by this invitation and by offering to the Royal College my sincerest appreciation of the work it is doing for the general welfare. May it and all its works continue to flourish in that service to the community which is the most perfect of human freedoms.

CEREBRAL ANGIOGRAPHY IN NEUROSURGERY.

Part I. THE ANGIOGRAPHIC APPEARANCES IN CEREBRAL TUMOURS.

By J. L. Dowling.

Sydney

(from the University Department of Neurosurgery, Manchester.)

Historical.

ORIGINALLY neuro-surgeons relied on clinical methods alone to diagnose and localize intracranial lesions. Though these methods are accurate in many cases, there are numerous pitfalls and considerable assistance was rendered by pneumography, which was introduced by Dandy in 1918. However, there are certain limitations to this procedure; for example, though the situation of a tumour can often be inferred, its size cannot be gauged nor any hint of its histological nature obtained by pneumography alone.

A further advance was made in 1927, when Moniz, of Lisbon, commenced studying methods of filling cerebral vessels with radio-opaque dyes so that skiagrams could be obtained. He first injected the carotid arteries of patients who had died of cerebral tumours and later conducted many experiments on animals before evolving a technique suitable for clinical use. The procedure has been further developed by Moniz and numerous other workers, with the result that angiography has assumed an important place in the investigation of neurosurgical problems.

The Use of Angiography.

The term angiography, as opposed to arteriography, is used purposely, for it is not only the arterial pattern that interests the neuro-surgeon. Multiple X-ray films are taken to show the pattern of capillaries and veins as well as of arteries, because any or all of these elements may undergo changes in the presence of a tumour and produce characteristic appearances when filled with dye.

The great advantage of angiography in studying tumours is that more information than their site is usually obtainable. It may be possible to estimate the size and, not infrequently, the pathological type as well — valuable advances on the more limited information obtainable from pneumography. The latter, however, remains an essential procedure; it is necessary when, for example, clinical signs leave doubts as to whether a tumour is frontal or cerebellar. The other great field for the use of angiography is in vascular disturbances — aneurysms, cortical haemangiomas and thromboses. In the study of intracranial aneurysms an angiogram shows the sac filled with dye and a knowledge of its exact site is obtained. This is especially valuable where one is confronted with a subarachnoid haemorrhage with no indication as to the side on which the aneurysm lies.

Technique.

Some preliminary precautions are advisable before angiography is carried out. It is not wise to use injection of concentrated iodide solutions when there is renal insufficiency. If multiple injections are necessary, watch must be kept for signs of iodide overdosage which may be manifest by an immediate skin eruption. Another pre-operative decision is whether anaesthesia should be general or local. It is a useful working rule that co-operative patients nearly always tolerate the procedure with local anaesthesia, whilst the unco-operative will not, and, therefore, general anaesthesia is required.

The original contrast medium in general use was Thorotrast, but now the various iodine preparations used in pyelography are almost exclusively employed. The latter give excellent contrast on the film, but when injected, they cause burning pain which may make the patient move his head, thus spoiling the film. On the other hand, Thorotrast is quite painless, but gives relatively poor contrast; it also has weak radioactive properties which necessitates limiting the total amount injected to 30 cc. — a quantity, however, which is usually adequate. Injections may be made into any

part of the carotid system in the neck or into the vertebral artery, the vessels being exposed by operation or punctured percutaneously. The second method is becoming increasingly popular, though the open method is still widely employed and may be required if the former fails, or if following injection, carotid ligation is intended. When dye is injected, it will flow from the main arteries through the capillary bed to be collected into the veins and venous sinuses. All these sections can be shown on X-ray films taken at intervals during the injection. The technique at present available in most clinics involves changing films manually, and it should always be possible to obtain at least two films — the first when the arteries contain dye, the arteriogram, and the second, about four seconds later, when the dye is in the capillaries and veins, the phlebogram. When an apparatus is available enabling more than two films to be taken, exposures should be made at six and eight seconds, because it seems that the capillaries in some tumours may not build up enough concentration until then.

Following injection, haemorrhage from the needle puncture is seldom prolonged and ceases with pressure. On very rare occasions bleeding may be so persistent that arterial ligation becomes necessary. When the injections have been made percutaneously, a haematoma follows removal of the needle and, though it may be large, it rarely causes pressure symptoms, but should these arise, the clot must be removed. Epileptic convulsions, either Jacksonian or generalized, sometimes follow injection, but, in the writer's experience, have had no ill effects.

The normal arteriogram.

The range of what is considered normal in carotid angiograms is considerable, and Fig. I represents a normal appearance of a lateral film. The points to observe are:

(a) The sinuous course of the undivided artery as it passes through the cavernous sinus. This is "the carotid siphon" of Moniz.

(b) The division of the internal carotid into its two main branches, the anterior and middle cerebral arteries. This division occurs just above the anterior clinoid process.

FIG. I. Normal carotid arteriogram—lateral view.

(c) The anterior cerebral artery which may be seen dividing into two branches — the lower being the pericallosal branch forming a regular loop around the anterior end of the corpus callosum, and the upper branch the marginal callosal artery, which pursues an undulating course backward.

(d) The middle cerebral artery which is a single branch for only a short distance before forming a leash of vessels running backwards and slightly upward. It must be remembered that the first part of this vessel runs laterally so that it is foreshortened on a lateral X-ray film.

(e) Features which may often be seen are the ophthalmic artery, the posterior communicating and posterior cerebral arteries. Though the latter are branches of the basilar artery, they do occasionally fill on carotid injections.

Fig. II shows a normal antero-posterior view. The notable points are:

(a) The medial course of the internal carotid as it passes through the bony carotid canal from the neck into the cranial cavity.

(b) The division of the carotid into its main branches.

(c) The anterior cerebral artery running at first medially to the midline, whence it turns upward in a vertical direction.

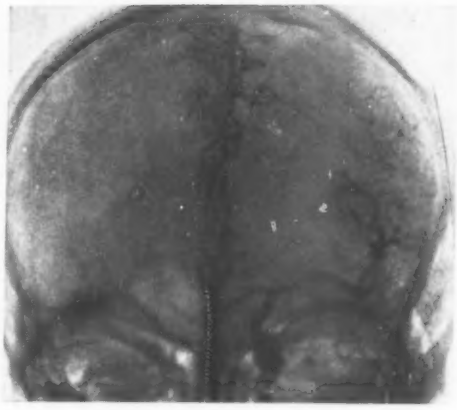


FIG. II. Normal carotid arteriogram—antero-posterior view.

(d) The middle cerebral artery running laterally before turning upward and dividing into numerous branches over the convexity of the brain.

(e) The passage of the artery through the cavernous sinus, as seen in this view, is completely different to that seen in the lateral view because the various curves of the artery appear foreshortened.

A normal vertebral angiogram is shown in Fig. III, where the basilar artery may be seen with its numerous branches, including its termination forming the posterior cerebral artery.

FIG. III. Normal vertebral arteriogram—lateral view. The basilar artery travels directly upwards and its largest terminal branch, the posterior cerebral artery, runs posteriorly. The smaller branches supplying cerebellum and brain stem may also be distinguished.

The normal phlebogram.

The appearances seen in phlebograms are not constant because they depend upon how far along the cerebral vessels the circulating dye has passed when the exposure is made. An early phlebogram will show up numerous small capillaries with the dye accumulating in some of the larger veins running over the convex surface of the brain. If the exposure has been made a little later, these veins over the convexity may be revealed emptying into the dural venous sinuses, and the appearance reproduced in Fig. IV occurs. This is a tracing of a film taken in the antero-posterior position, and in it both transverse sinuses and the superior longitudinal sinus are prominent, with the veins of the convexity shown entering the latter. During these intermediate stages, deep cerebral veins may come into view so that a lateral film can demonstrate the internal and great cerebral veins. A phlebogram taken in the latest stages will show the dye in the sinuses only. Veins are notoriously variable, and it is not important to demonstrate any in particular by angiography. The importance of a phlebogram is that sometimes a vein encircling a tumour becomes visible, and the actual tumour itself may be visualized owing to the concentration of dye in its capillary bed.

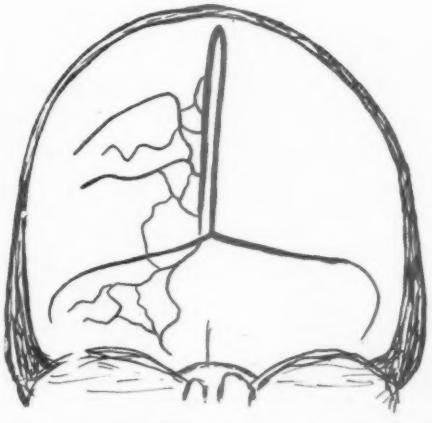


FIG. IV. Normal phlebogram in A.-P. view. In this particular phase, the superior sagittal and transverse sinuses are filled with dye, and some cortical veins enter the former.

THE INTERPRETATION OF ANGIOGRAMS.

Information is obtained from angiograms by virtue of distortion or displacement of main vessels (vessel shift), vascular pattern, or absence of vessels.

Vessel shift.

This is sought in the internal carotid itself and in the anterior and the middle cerebral arteries. In the cavernous sinus which has been invaded by neoplastic infiltration from the skull base, the sinuous course of the carotid is straightened out by the tumour growing upwards. This may be seen in Fig. V, where the artery has only one bend instead of the two seen in normal films.

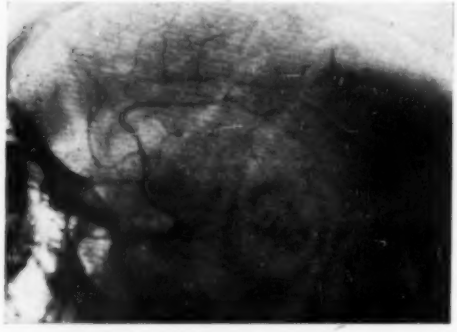


FIG. V. Arteriogram showing obliteration of contour of the internal carotid artery within the cavernous sinus. The artery is elevated by tumour growing up beneath it through the skull base.

The other two vessels are displaced from their normal positions depending upon the position of the tumour. A shift of the anterior cerebral artery occurs in unilateral frontal tumours and is best shown in the antero-posterior films. Fig. XI shows the artery transgressing the midline in a loop, but near the upper part of the film it swings back beneath the falx, causing a gross appearance somewhat resembling an inverted question mark. Tumours arising above or below the vessel push it downward or upward respectively, and this is more satisfactorily demonstrated in the lateral than in the antero-posterior views. The middle cerebral artery is typically displaced upwards by temporal masses — a displacement recognizable in both lateral and antero-posterior views. Fig. VI shows how the laterally directed portion of the middle cerebral artery has been lifted up and pushed medially by a mass in the temporal lobe, the effect being to diminish the angle of divergence of the anterior and middle cerebral vessels. The anterior cerebral artery is transgressing the midline, a fact which may be accounted for by the large size of this tumour. Fig. VII is the lateral view of the same case and shows the curved upward sweep of the artery produced by the temporal tumour lying beneath it.

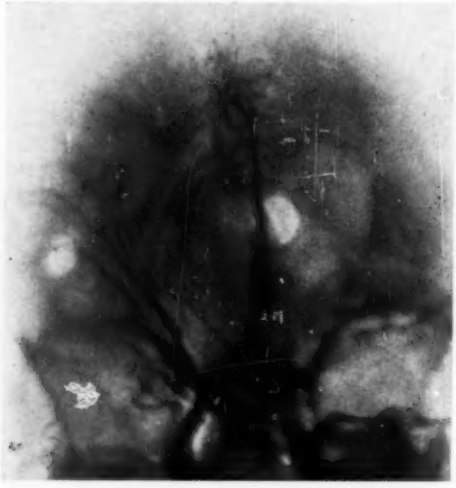


FIG. VI. Arteriogram showing (1) displacement of the middle cerebral artery medially and upwards, and (2) shift of the anterior cerebral artery across the midline. The effect is to render acute the angle of divergence of these vessels. (Compare Fig. II.)

Vascular pattern.

Normally the arteries divide into their smaller radicles in an orderly manner and careful study reveals an uninterrupted sequence of branches. In the presence of certain tumours alterations in this pattern are produced. Fig. VIII shows a haze of dye filling the capillary bed of a meningioma; Fig. XIV shows the extensive disorganizing influence of a malignant glioma which has completely obscured any normal pattern of vessels in the course of the anterior cerebral artery, whilst Fig. XVI shows the anterior cerebral artery running into the coiled mass of vessels forming a cortical haemangioma.

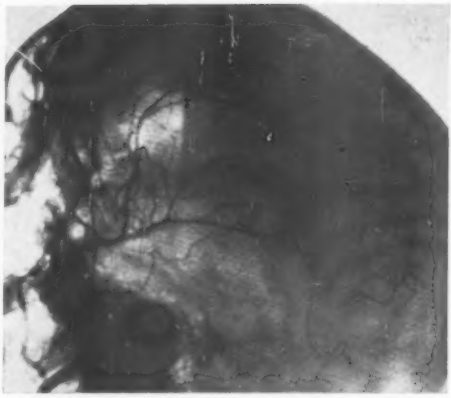


FIG. VII. Arteriogram showing (1) elevation of the middle cerebral artery by underlying tumour, and (2) widening of the curve of the anterior cerebral artery by dilated ventricles which contain a little air introduced by an earlier ventriculogram.

Absence of vessels.

Figures to illustrate the failure to fill of one of the main vessels have not been included. It is sufficient to say that arterial occlusion may be the result of thrombosis or embolism within the vessel, whilst spasm may possibly be another cause.

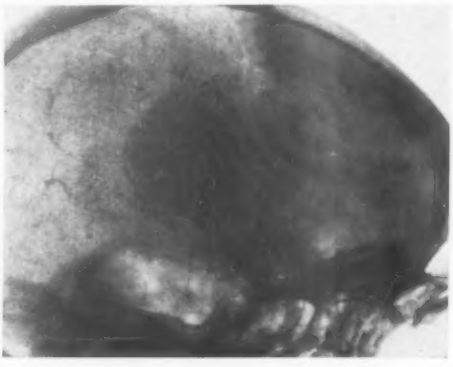


FIG. VIII. Early phlebogram showing the haze of dye diffused throughout the capillary bed of a large meningioma.

With these general principles of interpretation in mind, the appearances of specific types of cerebral tumour can now be described.

1. Meningioma.

Well timed angiograms give better preoperative information about meningiomata than do ventriculograms and are also much safer. These tumours give typical appearances of which the first is what we call the "meningioma haze." Figs. VIII, X and XI show circular areas of increased density in the position of meningiomata. This haze is the result of the filling of tumour capillaries with dye, the very multiplicity of the vessels causing diffusion of that dye. Fig. VIII is probably taken at the ideal stage, for here the exposure has been made when the smaller arteries and arterioles contain dye. Fig. X is a frank phlebogram, for no arteries are filled, but the small meningioma still contains dye and so remains visible. It is interesting to study Fig. IX, which was the arteriogram taken immediately before the former, because in it there is no sign of the haze — a point which will be referred to again. Fig. XI is an antero-posterior arteriogram from the same patient; it shows the shift of the anterior cerebral across the midline as well as the early development of the haze, suggesting that the dye has just begun to reach the tumour capillaries, though the main cerebral vessels are still filled.

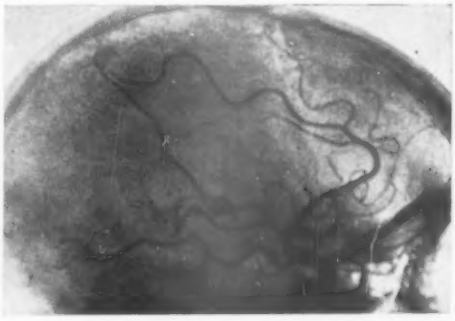


FIG. IX. Arteriogram showing the circumferential disposition of vessels around a small para-sagittal meningioma at the posterior limit of the anterior cerebral artery.

The second appearance seen with meningiomata is a circumferentially disposed vessel filled with dye. Such vessels are not part of a normal angiogram and their smooth, even course suggests that they surround a solid mass. Fig. XII shows this quite satisfactorily in the frontal region. Here may be seen a well-formed artery forming a little more than a semicircle with its concavity directed toward the frontal sinus. One could imagine this vessel cradling some mass in its concavity, which, in

fact, it was doing, the mass being a meningioma which was successfully removed. Note also that the anterior cerebral artery is not pursuing its usual smooth sweep around the corpus callosum, but has been distorted and pushed backward by the tumour growing in front of it.

FIG. X. Phlebogram taken about 4 seconds after Fig. IX displaying the development of the "meningioma haze." Some cortical veins also contain dye.

The lack of vascularity within the arterial concavity is surprising until one remembers that, were a film taken about two seconds later, the dye would probably be in the tumour capillaries, so producing the haze. That this is not mere conjecture is borne out by the facts of at least one case. Fig. IX shows a large anterior cerebral artery running back to the parietal region and dividing into two vessels which then proceed to run circularly as if around a mass, and in this they are joined by an upwardly directed branch of the middle cerebral. Fig. X, the phlebogram taken 3 or 4 seconds later, shows the meningioma haze perfectly; superimposition of the actual films verified that the two areas correspond. It therefore seems not unreasonable to argue that the two appearances are merely successive stages in the filling of the vessels, and further proof may be adduced with techniques allowing a larger series of films to be taken.

2. The gliomata.

(a) Malignant glioma (glioblastoma).

Hardman (1940), investigating the vascular arrangement in glioblastomata, showed that there were four zones involved. In the brain substance immediately surrounding the tumour the capillaries were fairly normal, whilst at the invading edge of the

FIG. XI. Arteriogram of the same case as Figs. IX and X showing the A.-P. view. Here the haze is well developed and the shift across the midline of the anterior cerebral artery is very apparent.

tumour there was disorganization of the normal uniform capillary network and occasional sinusoids occurred. However, sinusoids were best developed, though fewest in number, deep in the tumour at the edge of necrotic areas, and all malignant tumours had a necrotic centre where there were thrombosed sinusoids and blood extravasation.

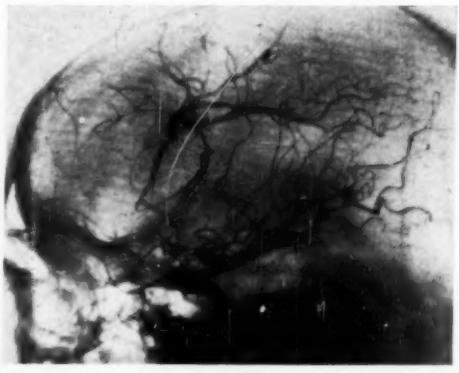


FIG. XII. Arteriogram demonstrating (1) the circumferential vessel surrounding a frontal meningioma, and (2) the displacement downward and backward of the anterior cerebral artery and supra-clinoid portion of internal carotid.

Though glioblastomata may be suspected clinically because, for example, of the development within a few weeks of a profound hemiplegia, proof is lacking on these grounds

alone, whereas in a proportion of cases angiography allows a definite diagnosis to be made. In the remainder it often provides sufficient information to localize the tumour accurately enough for a successful puncture biopsy to be made. When a diagnostic picture is obtained and the site and extent of the tumour defined, a decision can be made whether radical extirpation is possible. The angiographic diagnosis is based on the appearance of multiple sinusoids and the disruption of normal vascular pattern throughout the tumour area.

FIG. XIII. Arteriogram showing an area of grossly abnormal vascularity in the temporal region. A huge tortuous sinusoid is obvious at the posterior end of this area which is the vascular bed of a glioblastoma.

Fig. XIII shows this in an extreme degree. The upward displacement of the middle cerebral artery is apparent and beneath it is an area where there is no resemblance to any normal pattern. The striking feature is the large new vessel at the posterior end of the area; this is a sinusoid and its size is an expression of the vascularity of the tumour. The lack of filling of the anterior cerebral artery might be due to its obliteration by pressure of the tumour itself or of neighbouring oedematous brain. Fig. XIV also portrays an extensive glioblastoma. The same features are visible as before, but the sinusoids, though more numerous, do not attain the same large size. The neoplastic area is not limited as it is in the meningioma films — it is widespread and has no apparent limits. In the cases illustrated no surgical attack was feasible, but smaller tumours are encountered which can be totally extirpated.

(b) Benign gliomata.

Although there is an increase in the number of capillaries in these tumours, shown by reduplication and looping of vessels (Hardman, 1940), angiography does not reveal any characteristic pattern whereby a positive diagnosis can be made. It is usual to find only a vessel shift and a presumptive diagnosis must be made from the clinical details of the case. Figs. VI and VII are both of a patient who had an astrocytoma, and it can be seen that there is no evidence of any unusual vascular pattern.

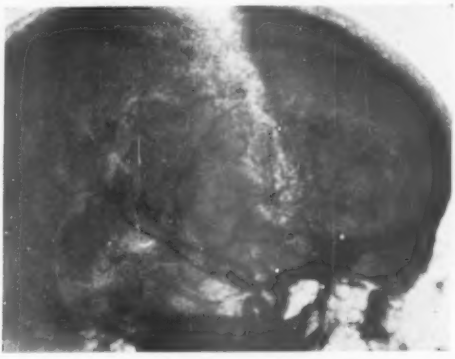


FIG. XIV. Arteriogram of a frontal glioblastoma. The disorganization of the vessels in the frontal lobe is quite apparent the numerous small corkscrew vessels being sinusoids. The anterior cerebral artery breaks up in this area and leaves no evidence of its normal course.

3. Haemangiomata.

Haemangiomata have been found far more frequently lately than before the development of angiography. They consist of large abnormal coils of vessels on the surface and in the substance of the brain. The majority are supplied by branches of either the internal or external carotid arteries, or both, but a very few occur on the basilar system alone. Free arteriovenous anastomoses are demonstrable within the mass. They are clinically a source of epileptic convulsions, spontaneous subarachnoid haemorrhage or intra-cerebral haemorrhage, which often causes hemiplegia. As it is a lesion which can, in some cases, be attacked surgically, its recognition is important.

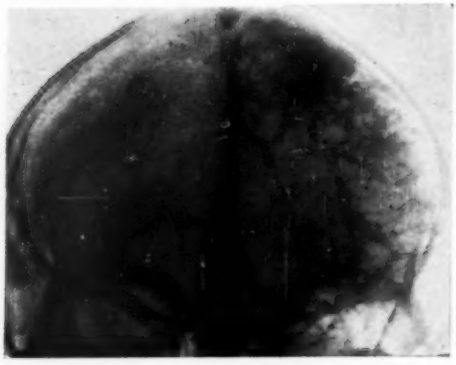


FIG. XV. Arteriogram showing the coiled mass of vessels forming a cortical haemangioma over the superior convex surface of the brain.

Figs. XV and XVI show the appearance of a posterior frontal haemangioma. The antero-posterior view reveals that the mass extends actually into the cortex in the shape of a wedge. The great development of the anterior cerebral artery is also apparent. The resemblance between this film and that shown in Fig. XIII is rather striking, and, on angiographic appearances alone, it could be extremely difficult to distinguish between the two. However, in practice the clinical features of the respective cases made the differentiation quite clear. Haemangiomata are sometimes filled by injection of the opposite carotid artery — an indication of the large volume of blood which they attract (Olivecrona and Riives, 1948).

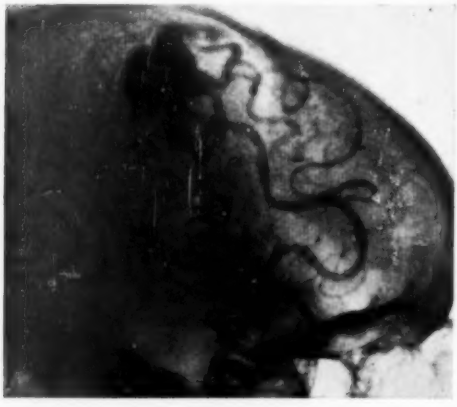


FIG. XVI. Lateral view of the same case. Note the hypertrophy of the anterior cerebral artery which supplies the angioma.

4. Metastatic tumours.

A variety of appearances has been described under this heading, which is hardly surprising, because these deposits come from many sources and assume different forms. A number of them are cystic and therefore relatively avascular, and a vessel shift is all that would be expected. On the other hand, they may be highly vascular and the vessel pattern may be confused with other types. Fig. XVII shows an apparently circumscribed area, which is at least suggestive of meningioma, lying above the air-filled ventricles. No primary growth having been found, this tumour was explored and proved to be a metastatic carcinoma. Engeset (1944) described spiral endings in arteriograms which occur at the end of the artery supplying the growth, and pointed out that these spirals may persist as a corkscrew-shaped vessel on the phlebogram. He considered this appearance very suggestive of metastasis, but it cannot be demonstrated in the figure reproduced.

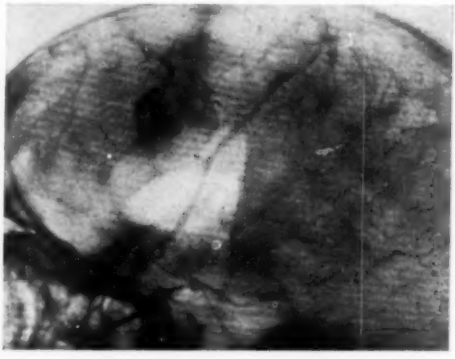


FIG. XVII. Phlebogram showing a circumscribed tuft hanging on a vascular pedicle in the frontal region above air-filled ventricles. This resembles a meningioma but proved to be a metastatic growth.

5. Suprasellar tumours.

In clear-cut cases of pituitary tumours and the cranio-pharyngiomata, angiography is not necessary. However, one may be confronted by patients with other tumours in a suprasellar position. The extent of these can be gauged from air studies, but angiography is necessary should an aneurysm be suspected. Bilateral injections must be anticipated, because the exact vascular

supply of midline sacs ought to be known before launching any operative attack. Without angiography pre-operative differentiation between an aneurysm and a supra-sellar meningioma cannot be made with absolute certainty.

SUMMARY.

(1) A short history of the development of cerebral angiography and a resume of its uses is given.

(2) Angiographic technique is described in general terms, together with pre-injection precautions and the possible complications which can follow injection.

(3) Normal arteriograms and phlebograms are illustrated and described.

(4) The method of interpretation of angiograms by vessel shift, alteration in vascular pattern and obliteration of arteries is explained.

(5) A series of angiographic appearances in the commoner types of cerebral tumour is reproduced with descriptive paragraphs on each. These include meningiomata, gliomata, haemangiomata and the metastatic tumours.

REFERENCES.

DANDY, W. E. (1918), *Ann. Surg.*, vol. 68, page 569.

ENGESET, Arne (1944), *Acta Radiol.* (Supplementum LVI.)

HARDMAN, J. (1940), *Brain*, vol. 63, page 91.

HODES, Philip G., PERRYMAN, Charles R., and CHAMBERLAIN, Richard H. (1947), *Amer. J. Roentgenol. Rad. Ther.*, vol. 58, page 543.

LIST, Carl F., and HODGES, Fred J. (1946), *Radiology*, vol. 47, page 319.

LIST, Carl F., BURGE, Curtis H., and HODGES, Fred J. (1945), *Radiology*, vol. 45, page 1.

MONIZ, Egas (1927), *Pr. Med.*, vol. 35, page 969.

—— (1934), *Arch. Radiol. Napol.*, vol. 9, page 629.

OLIVECRONA, H., and RIIVES, J. (1948), *Arch. Neurol. Psychiat.*, vol. 59, page 567.

PILCHER, Cobb (1946), "Surgical Treatment of the Nervous System." Philadelphia: J. B. Lippincott Coy., page 239.

ZEHNDER, M. (1937), *Zbl. Neurochir.*, vol. 2, page 339.

CEREBRAL ANGIOGRAPHY IN NEUROSURGERY.

Part II. THE ANGIOGRAPHIC APPEARANCES IN INTRACRANIAL ANEURYSMS.

By J. L. Dowling.

Sydney.

(from the University Department of Neurosurgery, Manchester.)

Intracranial Aneurysms.

ANEURYSMS situated upon intracranial arteries are by no means rare and are always of serious import either because they rupture and produce spontaneous sub-arachnoid haemorrhage or because they cause pressure on neighbouring structures. Most of these aneurysms occur on the circle of Willis and on the internal carotid as it traverses the cavernous sinus. The latter are the infra-clinoid aneurysms and those arising on the carotid distal to the sinus form the supra-clinoid group.

Before the advent of angiography, the diagnosis of intracranial aneurysms depended upon the history and clinical features of the cases. X-rays sometimes revealed calcification in the wall of an old aneurysm and sometimes changes in the skull were apparent such as enlargement of the superior orbital fissure and erosion of the lower and lateral boundaries of the optic foramen (described by Jefferson and Twining). But it was not until angiography came into regular use that their exact location could be unmistakably demonstrated. In the few cases where, even by this method, the sac cannot be seen, the assumption must be that thrombosis has occurred within the aneurysm or that the flow of blood through it is too slow to allow adequate concentration of contrast medium. Angiography only outlines the actual patent cavity of any sac — it can give no indication of the dimensions of the whole mass, which depend upon the amount of blood clot surrounding the sac. The total size can be gauged by pneumography, but it is rarely that such knowledge is required.

Technique of angiography for aneurysms.

The arteriogram is the essential part of this investigation and only a small amount of dye need be injected. The sac is filled after the injection of 5 to 8 cc. so that a film taken at this stage shows up both the vessel and sac. It is usual to take a phlebogram, for, in a proportion of cases, dye remains temporarily entrapped and the sac remains apparent (Fig. XIX). It is advantageous to carry out angiography by the open method because, immediately after injection, the carotid can be ligated in the neck if necessary. This obviates dissecting through a haematoma should the injection have been made per-cutaneously.

Supra-clinoid aneurysms.

The greater number of supra-clinoid aneurysms are situated at the base of the brain either on, or in close contact with, the circle of Willis. In this area lie certain structures which are prone to injury in the presence of an expanding lesion. These structures are the three components of the optic pathways (the optic nerves, chiasma and tracts) and the oculomotor (third) nerves. Pressure on the latter causes the most characteristic of all pictures referable to an aneurysm which is that of an isolated oculomotor palsy often accompanied by severe supra-orbital pain, though no objective sensory findings may be demonstrable.

About 10 per cent to 12 per cent cause pressure upon components of the visual pathways giving rise to various types of visual defects. Although the proportion is not large, it is enough to cause aneurysms to be included as a possible cause of visual failure. No defect can be said to be typical of aneurysmal pressure, for all varieties occur and the defect in any one case is liable to change between two examinations. The largest proportion have either a monocular central scotoma, amblyopia or blindness in one eye alone, or are associated with temporal hemianopia in the opposite eye.

However, any type of visual defect may occur, but an exhaustive discussion of them would be out of place in this paper.

FIG. XVIII. Arteriogram revealing an aneurysmal sac situated upon the proximal part of the anterior cerebral artery.

The presence of an aneurysm may be proved beyond doubt by angiography, and the appearances are, as a rule, characteristic. Fig. XVIII shows a large sac on the anterior cerebral artery. Fig. XX is an antero-posterior view in the same patient and shows that the sac is situated in the midline, thus endangering part of the optic pathways. Numerous other examples are available in which slight variations in the position of the sac relative to the midline can be shown, and the figure reproduced merely represents a type. A feature of this type is the presence of a visual defect of which the patient may complain primarily. Fig. XIX is a phlebogram showing how a large sac may retain dye long after the supplying artery is empty.

Where there is an isolated oculomotor palsy, the appearances are similar in lateral views, but in the antero-posterior film the sac is far more laterally placed. When so placed, it is unusual to find visual field defects, even though the mass still lies in close relation to the chiasma and the tracts.

FIG. XIX. Phlebogram to show how an aneurysmal sac will sometimes retain dye for a few seconds within its cavity.

Infra-clinoid aneurysms.

It is often possible to make an accurate clinical diagnosis in these cases, for they frequently conform to a rather characteristic picture. The internal carotid artery traverses the cavernous sinus in close association with the oculomotor, trochlear, trigeminal and abducent nerves, so that any expansion of the carotid in this region can injure any or all of these nerves. The resulting clinical picture, then, may include ptosis, complete ophthalmoplegia with pupilo-dilatation, and severe trigeminal pain. The latter is often only supra-orbital and associated with it there is objective interference with sensation (hypo-algesia, hypo-aesthesia, depressed corneal reflex). Figs. XXI and XXII show arteriograms of an infra-clinoid aneurysm. In the lateral view a circumscribed collection of dye obscures the pituitary fossa, and in both views it lies below the level of the anterior clinoid processes. It is noteworthy that the flow of blood through the sac is sufficient to fill the cerebral vessels distal to it (cf. arterio-venous aneurysm).

Though infra-clinoid aneurysms may reach a huge size, even stripping the basal dura laterally until they come to fill the middle cranial fossa, it is most unusual for them to bleed. A glance at their anatomical situation shows that they are restrained by rigid boundaries of bone and dura mater which must first be eroded before haemorrhage can occur.

FIG. XX. Arteriogram of same case as Fig. XVIII showing the midline position of the sac on the anterior cerebral artery.

Arterio-venous, or carotico-cavernous aneurysm.

A fistulous communication between the internal carotid artery and the cavernous sinus may result from rupture of an infra-clinoid aneurysm or from trauma. The latter may be direct, as by a knife wound through the orbit into the sinus, or it may be indirect through any head injury in which a line of fracture involves the greater wing or the body of the sphenoid. The clinical picture is somewhat dramatic because, when fully developed, there may be a loud bruit audible to patient and observers, total ophthalmoplegia, chemosis and pulsating exophthalmos. On the other hand, the arteriogram does not fulfill the dramatic promise of the clinical picture because no blood passes beyond the cavernous sinus. Fig. XXIII shows a picture identical to that seen with an infra-clinoid aneurysm, except that no cerebral vessels are visible, (the small vessels seen in the figure are branches of the external carotid artery).

If a satisfactory angiogram is to be obtained, the film must be taken very early during the injection, because the dye passes into the cavernous sinus through the fistulous opening and is drained away immediately without entering the cerebral arteries. If little or no blood is going to the hemisphere on that side, why, it may be asked, is there not a hemiplegia? Injections of the carotid on the unaffected side in these cases are of great interest in giving the reply. Fig. XXIV shows that from the one carotid artery, both anterior and both middle cerebrals have been filled and a complete blood supply to the entire brain provided. The corollary to this is that occlusion of the carotid on the side of the fistula should be perfectly safe, as, indeed, it was in this case.

FIG. XXI. Arteriogram showing the s of an infra-clinoid aneurysm. Note that the internal carotid and its branches distal to the sac fill well with dye.

Spontaneous sub-arachnoid haemorrhage.

The most frequent cause of spontaneous sub-arachnoid haemorrhage is from an intracranial aneurysm, situated on the main trunks or on the branches of the carotid or basilar systems. An infra-clinoid aneurysm will not be a source of sub-arachnoid leakage unless it erodes the tough dura mater enclosing it, and the same applies to the carotico-cavernous aneurysm.

Haemorrhage of this nature is a grave event. To quote one series of 150 cases (Magee, 1943), 52 died in the first attack. Of the 98 survivors, 50 had a recurrence of haemorrhage, of whom 32 died. He found

that the major incidence of the second attack was during the first month, an observation with which Poppen (1948) agrees.

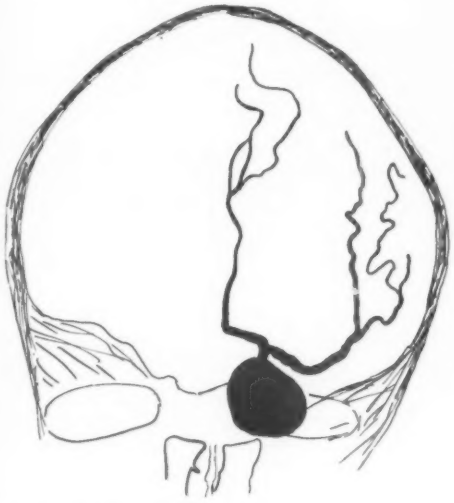


FIG. XXII. The antero-posterior view of the same case shown in Fig. XXI.

The argument which such figures develop is that for prompt intervention, because if the aneurysm is on the carotid system, a surgical attack is possible. The course to be taken, then, necessitates angiography, and should there be no physical sign indicating the side of the aneurysm, bilateral injections must be made. This is best carried out by the open method into the common carotid so that, once the presence of the sac upon a carotid or its branches is proven, that vessel may be tied without further ado. Should injection show both carotids to be normal, the aneurysm is presumed to lie somewhere upon the basilar system and so is surgically inaccessible.

The question arises as to what is the correct time to carry out bilateral angiography and arterial ligature. The optimum time is shortly after the first haemorrhage when the patient is recovering, possibly even during the first 24 hours. However, one is not infrequently confronted with a gravely ill, perhaps unconscious patient, who is continuing to bleed. Unless the prognosis is judged hopeless, desperate remedies may be justifiable in such a serious condition and the procedure outlined above should be carried out immediately.

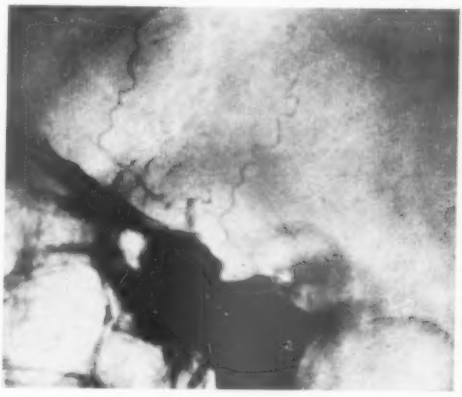


FIG. XXIII. Arteriogram showing a carotico-cavernous aneurysm. In contrast to Fig. XXI, the vessels distal to the aneurysm do not fill (the vessels in this figure are branches of the external carotid artery).

It must always be remembered that carotid ligature is a procedure which carries risks even under the most favourable circumstances, and those risks are increased when dealing with very sick people. Internal carotid ligation is more dangerous than that of the common carotid, especially when haemorrhage is actually in progress, and under such circumstances it is safer to occlude the latter vessel. The object is to diminish the blood flow through the aneurysmal sac, so promoting thrombosis within it. If necessary, the internal carotid can be ligated at a later date either in the neck or intracranially. These operations show better results if performed during a quiescent interval than when sub-arachnoid bleeding is in process. The problem is to decide whether the bleeding will cease spontaneously, so permitting the patient to pass into a more favourable state, or whether it will continue and create more desperate conditions. The decision to delay angiography and ligature may be fatal, yet precipitate surgery does not give the best results — such is the quandry in which we may find ourselves. It is probably wise in most cases to temporize, proceeding duly to an emergency operation if the clinical

condition deteriorates and the number of erythrocytes in the cerebrospinal fluid increases on serial counts.

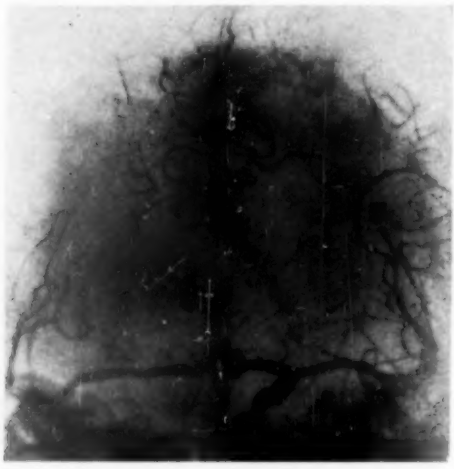


FIG. XXIV. Arteriogram obtained by injection of the carotid artery on the unaffected side of the same case in which Fig. XXIII was procured. The anterior and middle cerebral vessels of both sides have been successfully filled, indicating adequacy of blood supply to both sides of the brain from the one artery.

SUMMARY.

(1) Intracranial aneurysms are briefly discussed with particular reference to the angiographic technique used in their diagnosis.

(2) A series of tracings of angiograms is reproduced showing aneurysms in various situations. Their symptomatology and treatment are indicated.

(3) The relationship between aneurysms and sub-arachnoid haemorrhage is stressed and a line of surgical management discussed.

In conclusion I wish to acknowledge my indebtedness to Professor Geoffrey Jefferson and the University Department of Neurosurgery, Manchester, for invaluable assistance in the preparation of both parts of this paper, and permission to reproduce the photographs and tracings of angiograms belonging to the Department.

REFERENCES.

BEADLES, Cecil F. (1907), *Brain*, vol. 30, page 285.

JEFFERSON, Geoffrey (1937), *Brain*, vol. 60, page 444.

—— (1938), *Brit. J. Surg.*, vol. 26, page 267.

—— (1947), *Proc. Roy. Soc. Med.*, vol. 40, page 694.

MAGEE, C. G. (1943), *Lancet*, vol. 2, page 497.

POPPEN, J. L. (1948), *Amer. J. Surg.*, vol. 75, page 178.

SCHORSTEIN, J. (1940), *Brit. J. Surg.*, vol. 28, page 50.

GAS CYSTS OF THE INTESTINE.

By E. S. J. King
Melbourne

It is always good for one to have two strings to his bow.
John Florio, First Fruites, Fol. 6.

CYSTS containing gas are found in various parts of the body, such as the mucosa of the urinary tract and in the vaginal wall during pregnancy, but the best known condition occurs in the alimentary tract. Nevertheless it is uncommon and when seen for the first time by a surgeon is usually cause for astonishment if not perturbation. There are many accounts scattered through the literature and though no attempt is made to review these in detail the principal observations are collected together here.

The condition has been referred to as "gas cysts of the intestine," "emphysema of the intestine" (or one of a number of variants of this), "pneumatosis cystoides intestinalis" and even merely as "multiple cysts" of the bowel. The various names are good descriptive terms and indicate the main general features. It has been found both in man and in animals, especially the pig.

Historical.

It is usual to imagine that most conditions were not observed prior to the time when medical literature, as we now know it, began to accumulate. Most diseases therefore are said to have been described first during the last century.

These gas cysts however attracted attention, possibly because of their unusual features, much earlier. We read that there was a specimen of the condition in Ruysch's Anatomical Museum in Amsterdam in 1737. Specimens were observed by Haller and Cloquet. An example obtained from a pig was placed in his museum at the Royal College of Surgeons by John Hunter. This specimen was presented by Edward Jenner and the gas was analysed by Henry Cavendish, so that this condition was studied by three of the most famous investigators of the end of the eighteenth century.

A formal description of a case in a human being (associated with volvulus) was published by Bang in 1876. In 1908 Finney applied the apt simile of "soap bubbles" to the appearance of these cysts. Reports were sporadic but the continued interest in the condition in Britain was shown by published papers and reports such as those of Nitch (1924), who collected 85 cases from and gave an excellent review of the literature, Silverstone (1928), Lamont (1928) and Pybus (1934). References to cases are to be found also in papers not dealing primarily with the condition (Lendrum, 1948). The American literature was reviewed by Jackson and Lindsay *et al.* (1940).

The X-ray appearances were recognised by continental observers and those regarded as characteristic of the condition were presented recently by Lerner and Gazin (1946). Attempts have been made to indicate possible methods of clinical diagnosis. During the war years several cases and groups of cases were recorded in Scandinavia and in the South and Central American countries.

Knowledge of the condition in swine has run a similar course. Sporadic descriptions appeared during the last century and in the years just before the war some experimental investigations had been made (Biester *et al.*, 1936, Eveleth and Biester, 1938).

General Features.

Gas cysts of the intestine are found in both man and swine but much more commonly in the second. A failing of some human pathologists (and hence surgeons) is a disinclination to accept help which can be obtained from veterinary pathologists. This can scarcely be entirely a matter of implied superiority of the human organism since experimentally many animals are used. Nevertheless we seem hesitant of using information obtained about naturally occurring diseases. Of course the greatest care must

be exercised in applying to one species deductions drawn from diseases of another. In this case we have sufficient examples of the condition as it occurs in man to act as checks on conclusions drawn from the more readily observed disease in swine. Observations show that the condition in man and pigs is very similar in most if not all respects. For this reason animal material is used here to illustrate features not illustratable (because not easily obtainable) from human sources.

The condition occurs in a localised region of the intestine from jejunum to transverse colon and the order of frequency of occurrence is ileum, caecum and ascending colon and then jejunum. Less commonly cysts are found in the wall of the stomach and only rarely in the lower part of the colon. They occur also in lymph nodes adjacent to an area of bowel cysts and in the omentum.

Most of the cases have been observed in adults—mainly in later life—but a few have been encountered in children (Lindsay *et al.*, 1940). There does not appear to have been any special sex incidence.

Cysts may develop in the absence of any other abnormal condition and, as will be seen, this is specially obvious in the cysts found in swine. In human beings, however, a considerable number are found in association with some pathological state. With many of these—hernia, volvulus of the bowel, parasitic infestations, appendicitis and carcinoma of the stomach—it seems probable that the association is accidental and indeed the cysts are found only because of the attention attracted by the associated condition. In a considerable number of cases however a chronic duodenal ulcer has been found and these constitute too large a group to be dismissed lightly.

The condition has a limited life history with return of the affected part to normal. This has been shown in human beings by the discovery of a normal intestine (though with a somewhat cicatrised serosa) at a second operation three months (Silverstone, 1928), nine months (Mori, 1907), two years (Mills, 1925) and four years (Jackson, 1940) after the first observation.

MACROSCOPIC APPEARANCES.

The cysts range in size from minute structures less than 1 mm. in diameter to those of about 2 cm. in diameter; the average size (though varying somewhat in different cases) is about 5 mm. Occasionally cysts as large as 10 cm. in diameter may be seen. The cysts are spherical in shape and contain gas which is under pressure only slightly greater than atmospheric.

FIG. I. Photograph of abdominal operation field showing a segment of ileum with numerous gas cysts. Laparotomy was performed on a male aged 62 for a stenosing duodenal ulcer. The patient had been on a carbohydrate diet for several months.

The gas cysts are present in clusters in and on the wall of the intestine and give a curious frothy appearance to the tissue. They are usually very numerous and involve segments of the intestine of various lengths. Often several zones separated by normal bowel are found.

The wall of the gut is thickened and feels firmer and less pliable than the unaffected portions. There are areas in which localised thickenings may be felt. When the bowel is opened the thickenings are found to be mainly thickened submucosa due to accumulation of gas in this region. These swellings may be localised or diffuse. The localised accumulations make polypoid projections into the lumen.

Cysts on the surface of the gut may be on the antimesenteric border or on the mesenteric aspect when they project into the mesentery or from one leaf of the mesentery near the attachment to the intestine. Those on the serous surface may occur singly as well as in groups. It is common for them

to be pedunculated, being attached to the gut by a thin fibrous pedicle which may become twisted.

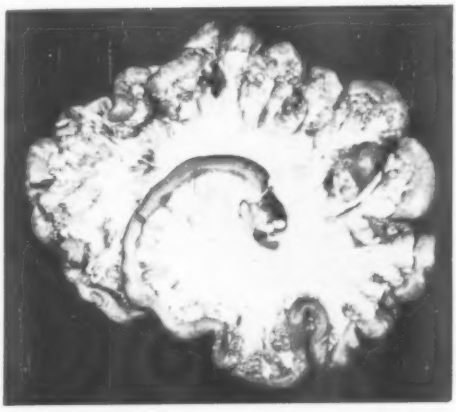


FIG. II. Photograph of loops of ileum from a pig (white "baconer," 165 lbs.), shewing many gas cysts principally near the mesenteric border and in the mesentery.

Cysts frequently develop in the mesentery away from the bowel and thus the mesentery becomes thickened. The cysts not only expand the leaves of the mesentery but may project from one or other aspect of it into the peritoneal cavity. Some of these may become pedunculated and twist on their pedicles. Sometimes such mesenteric cysts may be present when there is none on the serous surface of the bowel and *vice versa*.

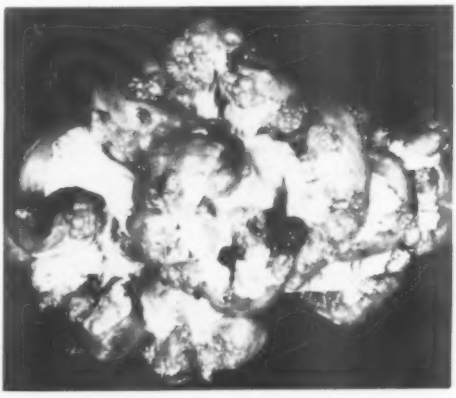


FIG. III. Photograph of loops of ileum from a pig (white "baconer," 145 lbs.), shewing numerous groups of gas cysts. Some cysts contain bloodstained fluid and some are large.

Lymph nodes are commonly enlarged and when these are sectioned they are found to contain gas cysts of various sizes.

The walls of the cysts on the serous surfaces are strong though thin and usually the contents are entirely gaseous. Occasionally a cyst contains a little blood-stained fluid. The blood is a bright red colour. Such cysts are usually few in number and are scattered apparently haphazardly amongst the other cysts.

MICROSCOPIC APPEARANCES.

Under low power magnification small cysts are seen in the mucosa and a larger number of bigger cysts occupy areas of the submucosa (Figs. IV and V). Local accumulations of these cysts cause the polypoid projections into the lumen (Fig. VI). The cysts vary greatly in size and by mutual pressure may deform each other. Very few are to be found in the muscle coat (Fig. IV), but cysts essentially similar are present outside this layer particularly projecting into the mesentery (Fig. VII). Similar ones are to be seen in the lymph nodes (Figs. IX and X).

The fully developed cysts are lined by a layer of flattened spindle shaped cells which are interpreted usually as endothelial. In close proximity there are occasional wandering cells of the small round type and numerous giant cells. These giant cells may encroach on the lining and actually project into the lumen (Fig. VIII).

Some of the cysts contain a faintly staining material which appears to have been liquid and in this there are often collections of wandering cells and giant cells.

The smallest spaces, too small and ill-defined to justify the designation of cyst, do not have any definite lining wall and seem to lie between tissue cells rather than in any defined cavity (Fig. XII). These are found in various parts of the tissues, even in the lymph nodes. They are interpreted as the earliest stages of cyst formation and suggest a local origin for the gas.

CYST CONTENTS.

The cysts contain gas which usually has been found to approximate closely to atmospheric air. It must be appreciated that, since the walls of the cyst are permeable to

FIG. IV. Photomicrograph (low power) of portion of the wall of ileum shewing gas cysts in the submucosa (one in muscle layer). (x 6)

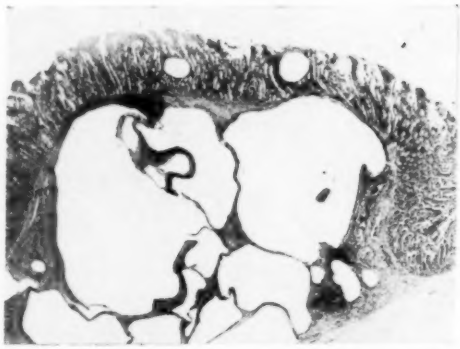


FIG. V. Photomicrograph of intestinal wall shewing cysts in the mucosa and larger ones in the submucosa. (x 12)

gases, when the cysts are exposed to the atmosphere interchange will occur rapidly so that the contents very soon are in equilibrium with the air. Even if examination be made immediately the abdomen is opened (or the cysts immersed in oil) it is apparent that the cyst gases previously will have been coming into equilibrium with the tissue gases and thus again with the external air. The only circumstance in which the cyst gas would be different is at the stage at which the gas is being formed and this applies probably only to the early stages of formation. This is probably the explanation of discrepancies between statements of different observers and for the reasons mentioned the writer considers that the few cases of gas estimations differing from those of ordinary air (and different from the majority) are probably the most significant.

The gases found are nitrogen, oxygen, carbon di-oxide, hydrogen and traces of methane and sulphuretted hydrogen. Statements of the proportions of these found are of little value in the absence of the precise circumstances in which the observations were made. Thus an observation such as those of Krummacher (1898)

Nitrogen	Oxygen	Carbon di-oxide
84-90%	10-16%	0.3%

indicates clearly that any gases which were present in the cysts had come, either before or after opening the abdomen, into equilibrium with the outside air. An observation such as Jaeger's (1906)

Nitrogen	Oxygen	Carbon di-oxide	Hydrogen
6.1%	5%	15%	73.3%

suggests that although some interchange may have occurred there has been formation of carbon di-oxide. The possible significance of trace gases is quite uncertain; they may have been formed locally or have come by diffusion from the bowel.

FIG. VI. Photomicrograph of ileum shewing groups of gas cysts in the submucosa producing projections of mucosa into the lumen. (x 4)

Sometimes a little fluid of serous character is present in a cyst and occasionally a small amount of blood is found. The oxygen present in the gas accounts for its bright red colour.

APPEARANCES AT OPERATION.

For practical purposes the cases diagnosed ante-mortem have been found accidentally at operation during laparotomy for some other condition. This emphasises the silent character of the condition.

During laparotomy free gas may be observed to escape from the peritoneal cavity but this (due to the rupture of one or more cysts) is rare. Usually the characteristic cluster of cysts is seen in the omentum or mesentery or projecting from the serous surface of the intestinal wall. The features are found to conform with those described above.

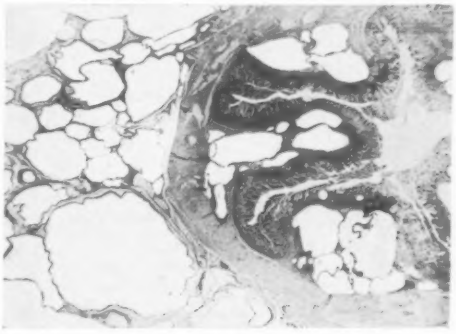


FIG. VII. Photomicrograph of ileum shewing cysts in submucosa and in the mesentery. (x 4)

The involved area or areas of intestine are thickened and the polypoid thickenings in the mucosa may give an irregularly nodular character to the gut. The cysts vary considerably in size and they do not communicate with each other or with tissue spaces. If they be compressed sufficiently they rupture with a sharp "plop" but the contents does not pass into the adjacent tissues or cysts. Some of the pedunculated cysts have long pedicles (as much as 5 cm.) and torsion of some of them may be observed.

In some cases small white papules are present on the peritoneal surface and these are interpreted as being collapsed cysts. Irregular fibrosis of the subserous tissue is sometimes apparent and villous thickenings of the serosa may be seen between the cysts. Ultimately when the condition has subsided and the cysts have disappeared all that is to be seen is an irregularly roughened serosa.

CLINICAL FEATURES.

Attempts have been made to emphasise features which might constitute clinical syndromes. Various types depending on the presence of a mass, the occurrence of intestinal obstruction or a similarity to acute appendicitis have been described. However, laudable though such attempts to establish recognisable syndromes may be, the fact is that the condition does not usually produce any recognisable clinical features and if rarely such be present there is no satisfactory purely clinical method at present of establishing the diagnosis.

FIG. VIII. Photomicrograph of portion of the mesentery (from the case illustrated in Fig. I) shewing a gas filled space (? lymphatic vessel) with giant cells of foreign body type in the wall and projecting into the lumen. There are more wandering cells in the neighbourhood than are usually seen. (x 180)

RADIOLOGICAL FEATURES.

These are dependent on two phenomena—encroachment of cysts on the lumen of the intestine and the presence of gas in the thickened wall. Occasionally gas in the peritoneum may be recognised.

The opaque meal shadow shows irregularities in the form of filling defects which indicate polypoid projections into the lumen. In addition it may be possible to demonstrate the thickness of the intestinal wall. This shows translucent areas suggesting gas bubbles and when this is seen along the margin of the shadow of the opaque material in the lumen the diagnosis is clear. These features have been demonstrated recently by Lerner and Gazin (1946).

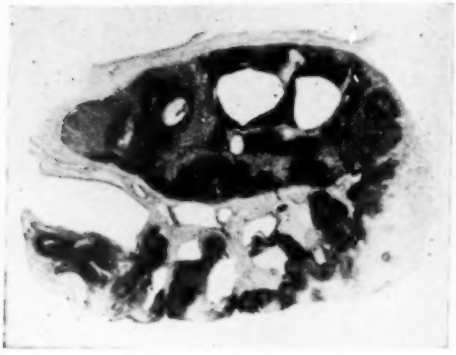


FIG. IX. Photomicrograph of a lymph node shewing gas cysts of various sizes in the medulla of the node. Gas is not found in the peripheral sinus as would probably be the case if it were propelled to the region mechanically. (x 10)

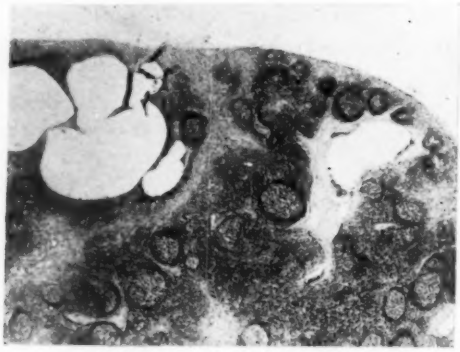


FIG. X. Photomicrograph of portion of a lymph node shewing well-formed cysts and one which contains fluid material (and cells) as well as gas. (x 15)

AETIOLOGY.

Various suggestions have been advanced to account for these cysts. Conjectures made in the last century such as their being the result of degenerative changes in neoplasms need not be considered seriously now. The principal current views are that the gas has a mechanical, bacterial or chemical origin. A point insufficiently emphasised is that an important part of the phenomenon is the retention of gas in the tissues with the formation of the cysts instead of its rapid absorption as usually occurs. However the origin of the gas must be discussed first.

The mechanical idea, put forward by Mayer over 120 years ago, is that intestinal gas is forced into the wall of the gut through some break in continuity of the mucosa. This guess can be disposed of readily by recourse to a few observations.

i. The chemical composition of the gas does not conform with that of intestinal gas. In cases where precautions are taken to examine gas before it has come into equilibrium with the external air it is clear that the cyst gas contains much more hydrogen and oxygen than intestinal gas.

	Oxygen	Nitrogen	Hydrogen	Carbon di-oxide	
Intestine	0.5%	45%	14%	40%	Ellenberger
Cyst	5%	6.1%	73.3%	15%	Jaeger

If the cyst gas were intestinal in origin and in the process of coming into equilibrium with air, the oxygen increase and the CO_2 diminution would be explicable but not the greater hydrogen and smaller nitrogen percentage.

ii. The distribution of gas in different and separate parts of the gut could be explained only on the idea of several points of entry. This is possible but unlikely.

iii. The condition does not occur in many of the circumstances when there is high pressure within the intestine.

iv. A condition of emphysema (due to mechanical introduction of gas into the tissues) is quite different, in the distribution of the gas and the period during which it is found, from the gas cysts.

v. Gas introduced into the tissues is rapidly absorbed and does not give rise to cysts.

The hypothesis is discussed only because sometimes it is still mentioned, apparently seriously, as a possible explanation.

The bacterial origin has been explored thoroughly, but though this was thought to be the explanation early in the century no organism has been found consistently. Special investigations made in pigs, in which the condition can be produced experimentally, have failed to demonstrate appropriate organisms. The distribution of the gas in the tissues and the continuance of its production suggest that bacteria could be

responsible but, though organisms are found in the wall, these are not found consistently nor are they necessarily gas-producing.

FIG. XI. Photomicrograph of part of a lymph node shewing a space which contained gas and also fluid and cells of various types (mainly round cells and giant cells). (x 36)

Various groups of gas-producing organisms have been studied but none has been shown to have any relationship to this condition. An organism which produced this kind of change would be, since there is little or no evidence of ordinary inflammatory change, a saprophyte. It is possible that such an organism has been overlooked, but the argument noted by some of the earlier writers, that organisms do not usually produce oxygen, is still applicable so that it seems unlikely that the condition is due to the presence of organisms in the bowel wall.

The chemical hypothesis is that substances absorbed through the intestinal wall undergo chemical change with the formation of gas. The manner of its formation, whether in cells or in the tissue fluid between them, is not known. At one period it was suggested that the giant cells which lie in the cyst wall and sometimes project into it were responsible. There is no reason however for regarding these as more than foreign body giant cells — the result of some irritating material, probably a component of the gas. That the gas forms in lymphatics was suggested by Lamont, but the appearances of the tissues at early stages of the condition suggest that it appears in tissue spaces which are not necessarily lymphatic in nature.

The hypothesis receives support from the observation that the condition is closely dependent on diet. Gas cysts can be produced in a large proportion of an experimental group of pigs by feeding them on polished rice and a small amount of milk. A more complete milk diet obviates the condition though the addition of vitamin (B complex) does not influence its development.

In human beings the association with peptic ulcer, where the individual is on a special diet (likely to be poor in protein), seems to be significant in this regard. At present the origin of the condition is obscure and since human cases are so few it is unlikely to be elucidated by study of them alone. Furthermore since it is so common in swine and can easily be produced experimentally further knowledge will probably be obtained by its study in these animals.

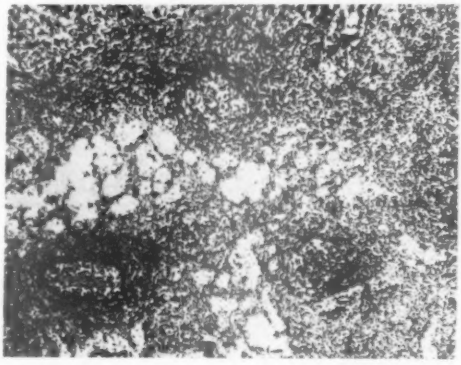


FIG. XII. Photomicrograph of part of the medullary region of a lymph node shewing small spaces where gas is appearing. (x 40)

SUMMARY.

1. Gas cysts of the intestine are uncommon in human beings but are observed occasionally, most often as an incidental observation at operation for other condition (frequently peptic ulcer).
2. The condition is common in pigs and may be produced experimentally.
3. It is self-limited; recovery occurs without interference.

4. A short review of the history of the condition and the main pathological features is given.

ACKNOWLEDGEMENTS.

I am indebted to Mr. Balcombe Quick for the photograph of the specimen seen at operation. Thanks are due to Dr. A. W. Turner, of the Council for Scientific and Industrial Research, Melbourne, who made available specimens of the condition in pigs.

REFERENCES.

BANG, B. L. F. (1876), *Nord. Med. Arkiv.*, vol. 8, page 18.

BIESTER, H. E., EVELETH, D. F., and YOSHIO YAMASHIRO (1936), *J. Amer. Vet. Med. Assoc.*, vol. 41, page 714.

ELLENBERGER, W. (1884-7, "Handbuch der vergleichenden Histologie und Physiologie der Haussaugethiere," vol. 2, page 819.

EVELETH, D. F., and BIESTER, H. E. (1938), *Amer. J. Hygiene*, vol. 27, page 364.

FINNEY, J. M. T. (1908), *J. Amer. Med. Assoc.*, vol. 51, page 1291.

JACKSON, J. A. (1940), *Surg., Gynec. Obstet.*, vol. 71, page 675.

JAEGER, A. (1906), *Verh. dtsch, path. Ges.*, vol. 10, page 251.

KRUMMACHER, O. (1898), *S.B. Ges. Morph. Physiol. Munchen*, vol. 14, page 90.

MAYER, quoted by NITCH.

LAMONT, D. (1929), *Glasgow Med. J.*, vol. 111, page 283.

LENDRUM, A. C. (1948), *Ann. Roy. Coll. Surg. Eng.*, vol. 3, page 32.

LERNER, H. H., and GAZIN, A. I. (1946), *Amer. J. Roentgenol.*, vol. 56, page 464.

LINDSAY, J. W., RICE, E. C., and SELINGER, M. A. (1940), *Arch. Path.*, vol. 30, page 1085.

MILLS, H. W. (1925), *Surg., Gynec. Obstet.*, vol. 40, page 387.

MORI, M. (1907), *Dtsch. Z. Chir.*, vol. 77, page 553.

NITCH, C. A. R. (1924), *Brit. J. Surg.*, vol. 11, page 714.

PYBUS, F. C. (1934), *Brit. J. Surg.*, vol. 21, page 539.

SILVERSTONE, J. (1928), *Lancet*, vol. 1, page 129.

THE TREATMENT OF TRAUMATIC ULNAR NEURITIS.

MOBILIZATION OF THE ULNAR NERVE AT THE ELBOW BY REMOVAL OF THE MEDIAL EPICONDYLE AND ADJACENT BONE.

By THOMAS KING.

With an appendix by FRANCIS P. MORGAN.

St. Vincent's Hospital, Melbourne.

THE operative treatment in general use for ulnar neuritis is anterior transposition of the nerve. This is true whether the neuritis is caused by irritation in the groove behind the epicondyle and inner part of the humerus from roughened bone, by scar tissue in the bed of the nerve in the groove, as a result of subluxation or less commonly dislocation of the nerve, as a result of stretching by cubitus valgus (the so-called "Maladie de Mouchet" (1896) although, according to Hunt (1916) Panas described this in 1878), as a result of nipping in cubitus varus, as a result of non-union of the medial condyle or Murphy was an exponent of the method in 1914. Platt (1928) has had a large experience, having performed over 100 operations and has found the operation most gratifying. He states that "the ideal procedure is anterior transposition, the merits of which are beyond dispute." He records no disadvantages. In this operation, after the nerve has been lifted out of the groove behind the "epicondylar pulley" it should be looped in front of the epicondyle. If the flexor muscles are bulging, well-developed and likely to cause stretching and kinking of the nerve, the muscle fibres should be partly divided and

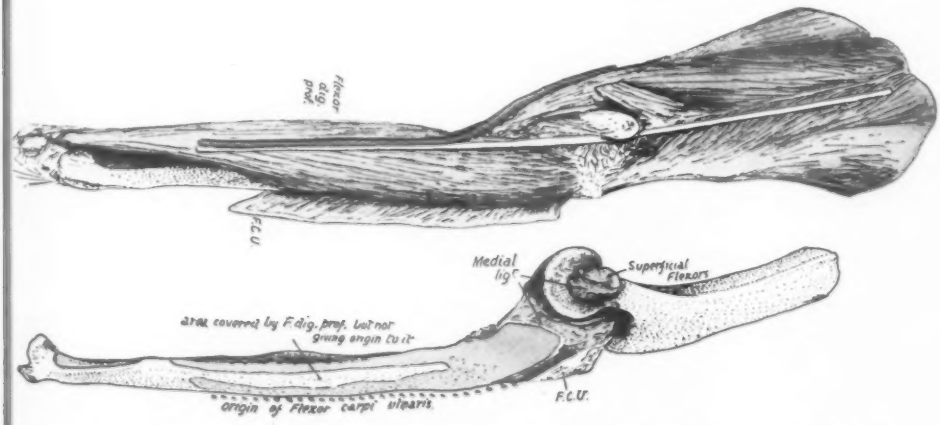


FIG. I. The drawing from J. E. Frazer's, "The Anatomy of the Human Skeleton" (1946, J. & A. Churchill Ltd., London) shows that the ulnar nerve should run in a straight course to its destination. The medial epicondyle causes stretching ("pulley action") on full flexion; if the nerve is transposed anteriorly, extension tends to stretch the nerve (Mouchet); but if the epicondyle is removed, the nerve can roll forward and neither flexion nor extension affects it.

exuberant callus, as a result of tension when a nerve severed in the forearm has to be bridged, as a preliminary to mobilization of the nerve for arthroplasty of the elbow, repair of the ruptured triceps or old ununited fractures of the olecranon. Roux of Lausanne (1857-1934) was the first to record this operation, according to Mouchet (1914), but the nerve embedded in the new position (Bunnell, 1948); but if the muscles are not well-developed, it may be allowed to lie subcutaneously between the superficial and deep fascia covering the common flexor muscle origins arising from the epicondyle. In the latter position, "it is more exposed to the danger of being contused, lacerated or

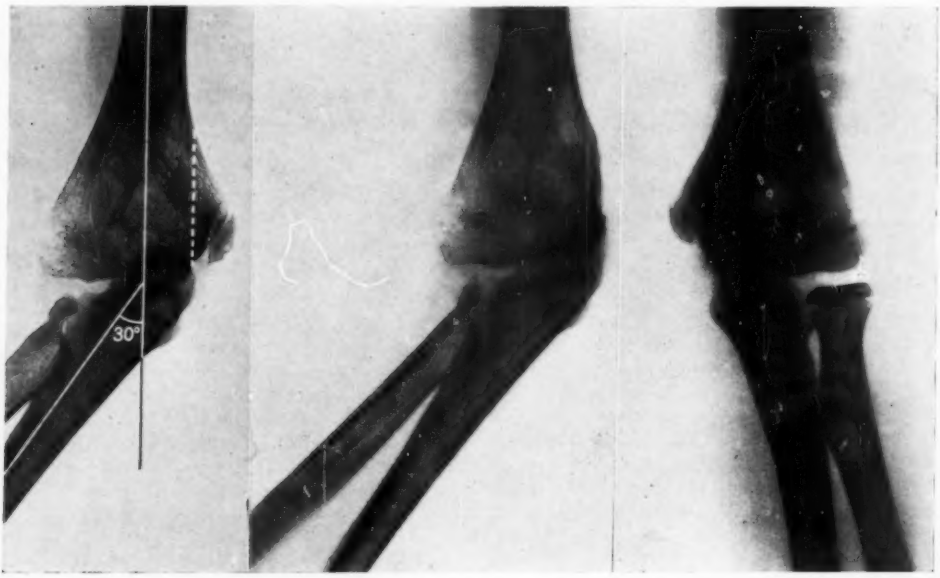


FIG. II. FIG. III. FIG. IV.

FIG. II. Head of radius (patient aged 8) removed elsewhere in March, 1948; now complains of pain in ulnar nerve distribution to fingers; no neurological signs. The carrying or valgus angle (30°) is double the normal.
FIG. III. Medial epicondyle and adjacent diaphyseal bone have been excised. There were no symptoms on 16th Feb., 1950.
FIG. IV. Right elbow (normal) is shown for comparison.

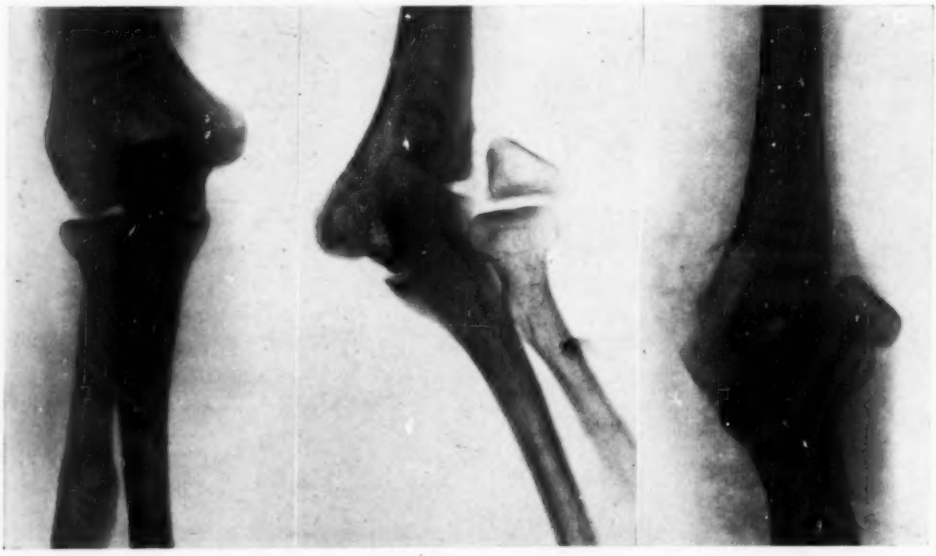


FIG. V.—5th Feb., 1950. FIG. VI.—5th Feb., 1950. FIG. VII.—21st Feb., 1950.
Same patient as in Figs. VIII-X.

FIG. V: Normal elbow is shown for comparison.
FIG. VI: Patient aged 43; fracture of the external condyle at age of 3 years; now has symptoms and signs of ulnar neuritis.
FIG. VII: The medial epicondyle and adjacent bone were removed on 7th Feb., 1950.

severed in an accident, yet it is not exposed to recurrent traumata as before" (Murphy, 1916). But if the nerve is buried in the muscles—which is well shown in the coloured illustration in Watson-Jones' textbook—there sometimes follows a fibro-cicatrical strangulation of the nerve. I know of three instances; in one of these, the nerve was replaced at a second operation in the groove behind the epicondyle. Rand (1944) gives the following account of this complication:—"The nerve was explored, on August 26, 1938, and showed the typical thickening seen in such cases. The nerve was transplanted in front of the internal condyle, being anchored beneath the fascia and attachments of the flexor muscles. Following this, his hand became weaker, more awkward and more atrophied. All intrinsic muscles of the hand supplied by the ulnar nerve were greatly atrophied. He showed a typical ulnar *griffe*, being unable to straighten the little or ring fingers. He could not adduct or abduct the little finger. There was complete anaesthesia in the sensory distribution of the ulnar nerve in the hand. The nerve was again explored on January 18, 1940, when it was found to be firmly bound under the fascia and attachments of the flexor muscles in its transplanted bed. Rather firm adhesions had formed about the nerve. It was dissected free and left in the anterior position just under the subcutaneous tissues. There was moderate return of sensation in the hand, following this operation, and over a period of months a lessening of the atrophy. The grip slowly improved." Mr. John Hoets (Sydney) had the same experience recently. He was consulted by a patient who had been operated elsewhere for bilateral ulnar neuritis; the nerves had been transposed anteriorly and buried in the flexor

FIG. VIII. (Above): (Same patient as in Figs. V-X) 1st Feb., 1950. A gross valgus deformity and prominence of the internal epicondyle of the left elbow is apparent.

FIG. IX. (Lower Right): (Same patient as in Figs. V-X.) 1st Feb. 1950. Hypothenar and thenar eminences are wasted. At operation stimulation of the nerve to the flexor carpi ulnaris resulted in a muscle contraction.

FIG. X. (Upper Right): (Same patient as in Figs. V-X.) 1st Feb., 1950. The interossei muscles are moderately wasted.

muscles. This had the effect of increasing the signs and symptoms. At operation he found both nerves were being strangled by a fibrous tissue reaction around them. He dissected the nerves and placed them subcutaneously. This would have been a suitable case for epicondylectomy. Learmonth (1942) tried to avoid this danger—although he did not state that it was for this purpose — by detaching the common flexor origins from the medial epicondyle, raising the nerve and displacing it forward and laterally so that it lay close to the median nerve and then reattaching the muscles to the epicondyle. Bunnell (1948) detached the tendon of origin of the flexor profundus muscle (the most posterior of the common flexor group) and then brought the nerve forward so that it lay between the origins of the pronator teres and flexor sublimis muscles in front and the flexor profundus behind; the latter was then re-attached to the epicondyle. But strangulation of the nerve in its new position could still take place. The manoeuvres of Learmonth and Bunnell were perhaps inspired by the method used when the ulnar nerve had been divided in the vicinity of the elbow; in this case the lower part of the nerve can be drawn through a tunnel between the two muscles. In all the above four methods of transplanting the nerve, the purpose is to make a detour of the irritant object — the prominent medial epicondyle and adjacent humerus. This bone is of considerable size in adults or in younger patients when cubitus valgus follows a fracture of the external condyle (Fig. II). Another accident of anterior transposition is kinking of the nerve above the epicondyle by the edge of the medial intermuscular septum and, in order to avoid this, a notch is often cut in the septum and a greater length of nerve is laid bare in order to mobilize it freely.

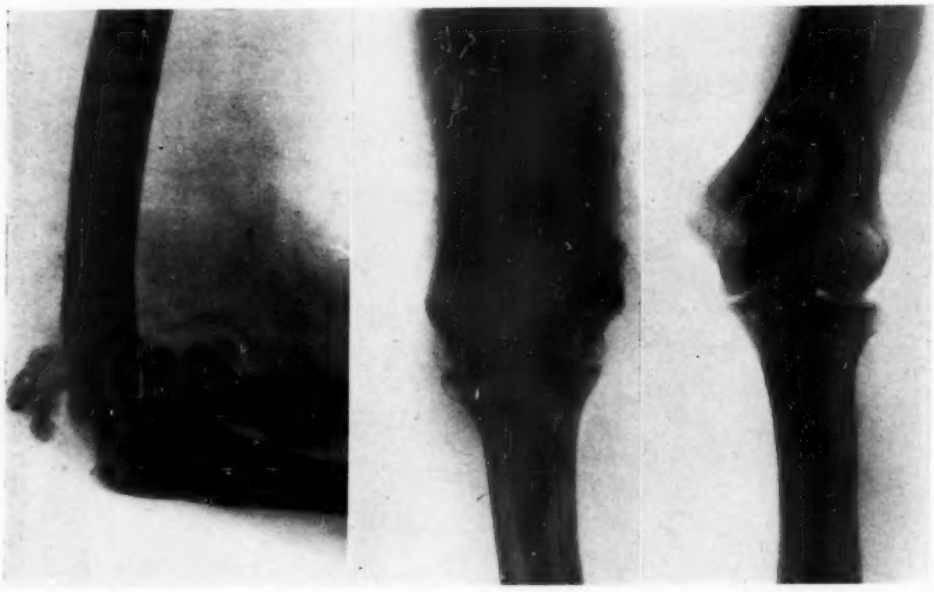


FIG. XI.—12th Nov., 1949. FIG. XII.—10th Feb., 1950. FIG. XIII.—10th Feb., 1950.

FIG. XI: Patient aged 31: ununited fractured olecranon of one year's duration: a wide defect in the triceps muscle and inability to extend forearm.

FIG. XII. (Same patient): At operation the triceps muscle was torn across nearly the whole width. The ulnar nerve was mobilized after removing the medial epicondyle. This permitted a repair of the triceps muscle; and removed the nerve from the vicinity of the scarring. The ununited olecranon was small and its removal permitted a good repair of the muscle.

FIG. XIII: The corresponding elbow is shown for comparison.

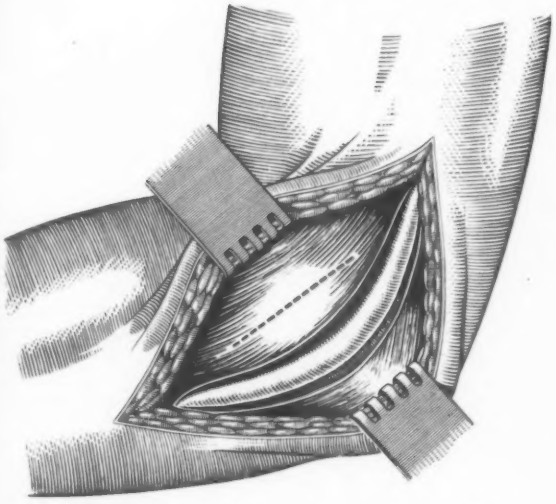


FIG. XIV. The ulnar nerve (neuroma) has been dissected from the groove behind the prominent epicondyle and lies close to the olecranon. In the treatment of an ununited fracture of the olecranon, the nerve can be mobilized by removing the epicondyle—see Figs. XI-XIII.

Most authorities now reject Mouchet's operation of supracondyloid cuneiform osteotomy for cubitus valgus because it is not so safe and satisfactory as nerve transposition; it appears from a recent paper by Mouchet and Seille (1949) that he now uses anterior transposition of the nerve. Mouchet (1937) stated that he conceived the osteotomy operation in 1914 because, after an experience of three anterior transplantations and seeing other patients who had been operated on, he thought the nerve was stretched on extension of the elbow and the pain remained. The medial epicondyle is the obstruction that has to be avoided in an anterior transposition operation. When the nerve is looped forward over this bone, it still remains a formidable prominence behind the nerve and the base of the epicondyle still raises the nerve. Although the course may be shorter now, it is still sinuous as the nerve winds its way into the forearm. But the nerve is no longer stretched when the elbow is flexed, as before operation: on the other hand, in full extension of the elbow there is now a tendency to lengthen the nerve.

Gay and Love (1947) have given a complete account of the various forms of operative treatment that have been used—twelve in all—including dealing with an anomalous artery and vein compressing the nerve at the elbow, but do not report about excision of the epicondyle except to state that one of the procedures consists of removal of bone fragments and loose osteo-cartilaginous bodies. The only reference that I can find in the literature is that of Mouchet (1937)—"I do not think that resection of the epicondyle practised in one case by Sorrell is very advisable." But it appears to me that it is a reasonable course to remove the irritant object — the epicondyle and adjacent bone. This simple procedure removes the cause and permits the nerve to roll forward. The well known drawing from Frazer's "Anatomy of the Human Skeleton" (Fig. I) illustrates how the ulnar nerve runs a straight course

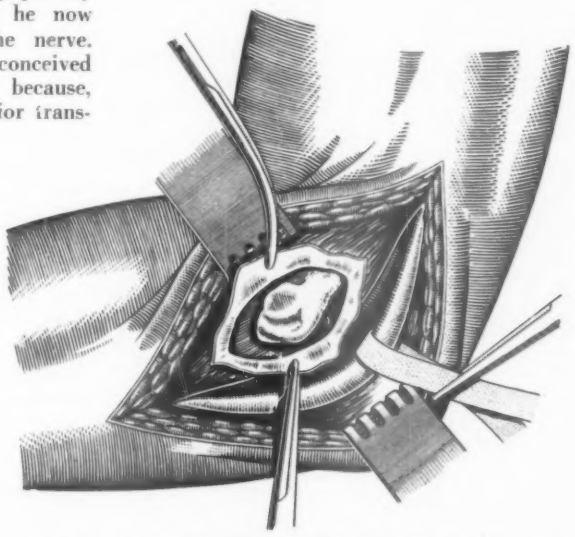


FIG. XV. The adjacent humerus (diaphysis) has been exposed as well as the epicondyle, by raising the thick aponeurotic-periosteal layers.

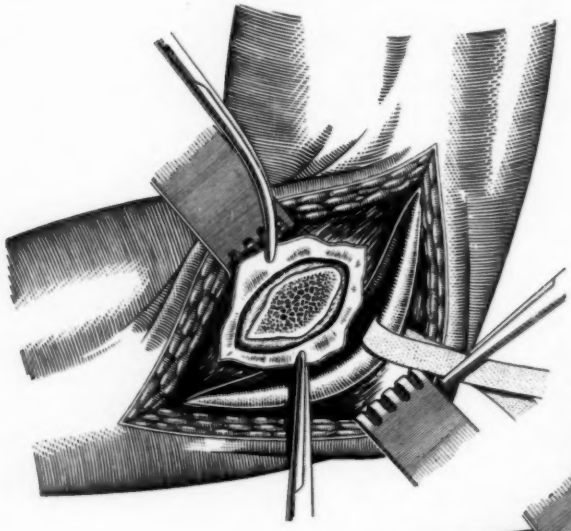


FIG. XVI. The epicondyle has been removed and the diaphysis shaved down until there is adequate room for the nerve to roll forward naturally.

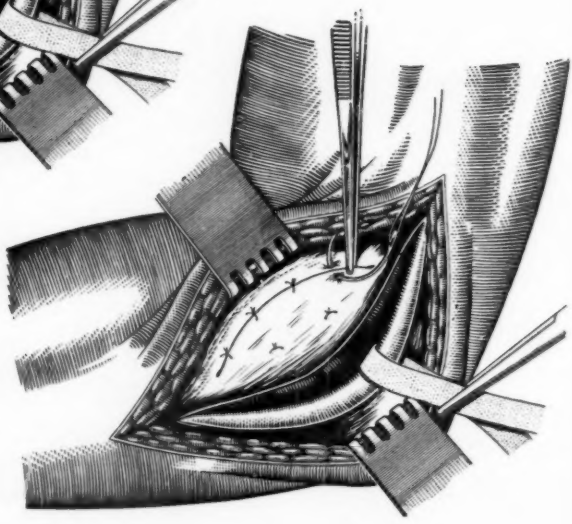


FIG. XVII. After the diaphyseal bone has been removed, the aponeurotic-periosteal layer is used to cover the raw bone; and is generally redundant so that it can be overlapped; and this leaves a good bed for the nerve.

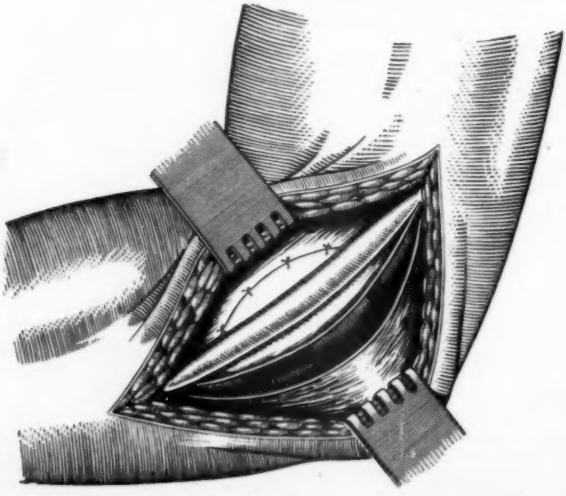


FIG. XVIII. The nerve has rolled slightly forward and lies on a smooth muscle bed.

to the wrist behind the prominent epicondyle. At the same time, it indicates how easily the nerve can be stretched even in a normal individual, if full flexion of the elbow with the arm abducted and the wrist extended is maintained for any length of time, because of the "pulley effect" of the prominent epicondyle. The possibilities of this little operation first occurred to me when removing an imprisoned medial epicondyle from the elbow joint in an adult. The bone had been avulsed through a split in the common flexor origin and when, after removal of the bone, this vertical tear was brought together neatly, the roughened bone surface was completely covered, and a smooth muscle bed now existed for the ulnar nerve which had moved forward slightly and naturally into an anterior position. Radley-Smith (1938) reported 32 patients with detachment of the medial epicondyle into the elbow joint, and in 23 there was a co-existing nerve palsy—of these 10 were complete—for which the nerve was transposed anteriorly in 11 patients.

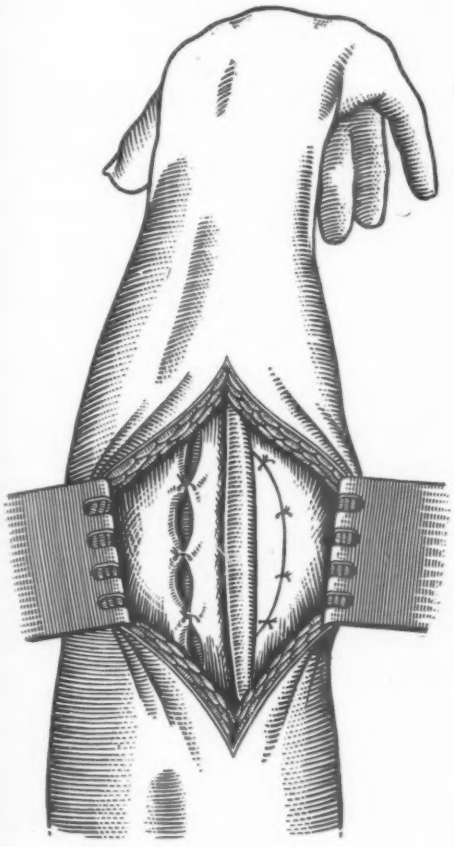


FIG. XIX. This position is usually adopted for operating. The arm is vertical and the elbow is flexed at a right angle, the forearm being held across the chest or above the shculder on the same side, by an assistant grasping the wrist. Note that the incision appears to be made over the "outer side" of the elbow, when held in this position; and if the limb is draped so that only the elbow is exposed, a mistake might occur in placing the incision over the radial side. The groove for the nerve has been partly obliterated by sutures; sometimes the nerve need not be removed from the groove (see appendix).

FIG. XX.—12th Dec., 1949.

FIG. XX. First seen on 27th Aug., 1945 complaining of pain and weakness (ulnar neuritis) for twelve months. There was hypothenar and interossei wasting; complete paralysis of adductor muscles and ulnar nerve paraesthesia. The medial epicondyle and adjacent bone was excised on 8th Sep., 1945. Four years later, there were no sensory changes, no pain and slight muscle weakness; and was working as a typist.

Since 1938 I have deliberately used the method of removing an intact epicondyle in 10 patients for ulnar neuritis following cubitus valgus and other causes. My colleague Mr. F. P. Morgan (neuro-surgeon)

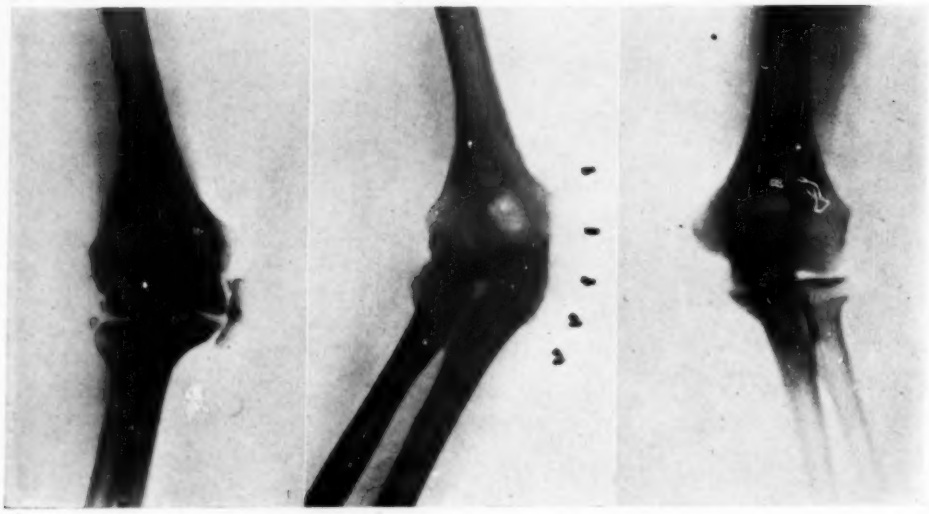


FIG. XXI. 20th March, 1950. FIG. XXII. 20th March, 1950. FIG. XXIII. 10th May, 1950.

FIG. XXI: Patient aged 19; had an ununited fracture of the medial epicondyle of many years' duration: it appears to have enlarged. Ulnar neuritis is now present, causing pain along the ulnar side of the forearm to the fingers. The flexor carpi ulnaris and hypothenar muscles are wasted.

FIG. XXII: At operation the base of the epicondyle and inner side of the humerus, as well as the dislodged epicondyle, were removed.

FIG. XXIII: The opposite elbow (normal) shown for comparison.

has used the method six times since 1942 and commends it; I have, therefore, ventured to publish this paper at his suggestion and with his encouragment.

OPERATION.

If the elbow movements are limited, the arm is held in the vertical position, with the elbow flexed to a right angle, over the chest wall (Fig. XIX) as advised by Platt (1928) or over the shoulder by an assistant holding the wrist; but if the elbow movements are not limited, the operation can be performed with convenience if the patient lies face downwards. Morgan attacks the epicondyle in a different manner (see appendix). The ulnar nerve is exposed where it is related to the epicondyle by a curved incision behind the nerve and not if front or parallel with it as this may involve the nerve in the skin incision when later it rolls forward. The flap is dissected forward from the deep fascia; and the nerve is discovered after dividing its fascial covering from the point of entry between the two heads of the flexor carpi ulnaris and two fingers breadth above the epicondyle (Fig. XIV). The nerve should be exposed above and then below the site of the neuroma before the neuroma is itself exposed. The long exposure of the entire course of the nerve in relation to the elbow is not, as a rule, required as when anterior transposition is performed. The faradic bipolar stimulation is used on the nerve proximal to and then distal to the neuroma, in order to determine the conductivity of the nerve fibres. If there is much scarring, this test determines if the branch to the flexor carpi ulnaris is functioning or not; and it should be preserved. But the articular branch is divided in order to allow the nerve to roll forward later. An incision 2 inches long is made over the aponeurotic and tendinous origins of the flexor and pronator muscles and the periosteum (Fig. XV). A $\frac{3}{8}$ inch chisel is used to separate those rather thick layers that clothe the epicondyle and its base where it extends to the adjacent humerus. This bone is now divided; a considerable amount more than the epicondyle should be removed. A flat surface remains; thus the nerve may roll

forward. The aponeurotic and periosteal flaps are now redundant; this is an advantage because they can be reefed or overlapped (Fig. XVII). This results in a smoother bed for the nerve which does not lie on bone or a line of sutures. The ulnar groove is obliterated by two or three sutures (Fig. XIX). If oozing is troublesome, it can be controlled by thrombin.

SUMMARY.

1. The medial epicondyle and adjacent bone (diaphysis) were deliberately excised in 16 patients with ulnar neuritis and for other causes including irritation in the groove, cubitus valgus and varus, as a preliminary step for arthroplasty of the elbow, for repair of ruptured triceps; for ununited fracture of the olecranon and also when the ulnar nerve had to be sutured at the wrist and there was a three inch gap to be bridged. Skiagrams of five illustrative cases are shown.

2. The results have been satisfactory. The minor neurological changes cleared up and where there were gross signs there was either improvement or no further progress of nerve degeneration and pain disappeared.

3. This simple operation appears to avoid the danger of fibro-cicatrical contracture, which occasionally occurs when the nerve is embedded in the flexor muscles and, perhaps, minimizes the danger of pressure upon it by external objects as can take place if the nerve is transposed anteriorly and subcutaneously.

APPENDIX.

By FRANCIS P. MORGAN.

I thank Mr. Thomas King for the invitation to add this appendix to his paper.

When, in 1942, he suggested that traumatic ulnar neuritis might be effectively treated by removal of the medial epicondyle of the humerus, one felt the new method offered certain advantages over the anterior transposition operation. The latter operation is satisfactory for ulnar neuritis localized behind the epicondyle, but sometimes fibrosis and contracture occur above the nerve in its new bed in the flexor muscles and this brings disappointment to patient and surgeon alike. This is mentioned by Rand, and Sir Hugh Cairns told me he had experience of it when I discussed the problem with him during his visit to Melbourne as Sims Commonwealth Professor. It appeared that the new operation would eliminate the unwanted complication.

Mr. King and I decided to employ the new method and did so independently. The following is a brief account of my experiences.

In all 6 cases of ulnar paralysis were treated—3 of tardy ulnar paralysis (Maladie de Mouchet) following injury of the lower end of the humerus and 3 of paralysis associated with thickening of the nerve behind the epicondyle, presumably due to irritation and friction, but without bony injury. The method was also used in one case to bridge a gap of one inch in the ulnar nerve severed just below the elbow joint.

My practice is to operate with the patient lying on his back and the upper limb abducted, palm facing upward. The incision, 5 inches long, is curved with convexity outward, i.e., to the radial side. Its mid-point lies opposite the medial epicondyle 1½ inches lateral thereto. The flap of skin is reflected medially and the condyle exposed. The next step is to clear the epicondyle and adjacent humerus back and front of its attached tissues. It is not necessary to expose the ulnar nerve and this, I believe, is one of the virtues of the operation. Should inspection of the nerve be required, such is readily accomplished. Since the nerve is not exposed, it is not handled and its branches are left intact. The epicondyle and adjacent humerus are nibbled away with bone rongeurs and thus the locus morbi is ablated. If haemorrhage from the raw bone is troublesome, it is stopped with Horsley's bone wax. The tissues which covered the bone are now loose and are sutured together over the raw bone and this ensures that the nerve still protected by its sheath, which was not disturbed, is secure from subsequent adhesion to the operated parts.

Mr. King has dealt with the advantages of the new operation in obviating scar in the flexor muscles, stretching of the nerve in extension, irritation by the medial intermuscular septum, etc. The fact that the nerve is not handled and that its branches and collateral vessels are left intact would seem to yield the following benefits:

(a) post-operative pain is less.

(b) recovery of function is more rapid, e.g., in old standing cases of the malady, patients are subjectively aware of improvement in two to three days and movement of paralysed muscles of the hand is evident in seven to fourteen days; abduction of fingers previously paralysed and the subsequent course is correspondingly satisfactory.

The results may be no better in the end than with a well-executed and satisfactory anterior transposition operation but improvement is more rapid. This is a striking feature. In addition the operation is easier and quicker to perform, requires less technical skill and by its nature is likely to give a greater percentage of successes. There is no evident weakness of the flexor pronator muscles by reason of their detachment from the condyle.

REFERENCES.

BUNNELL, S. (1948), "Surgery of the Hand." Philadelphia: J. B. Lippincott Company, page 349.

CONWAY, F. M. (1933), *Ann. Surg.*, vol. 97, page 425.

GAY, J. R., and LOVE, J. G. (1947), *J. Bone Jt. Surg.*, vol. 29, page 1087.

HUNT, J. R. (1916), *J. Amer. Med. Assoc.*, vol. 66, page 11.

LEARMONTH, J. R. (1942), *Surg. Gynec. Obst.*, vol. 75, page 792.

MOUCHET, A. (1914), *J. Chir.*, vol. 12, page 437, reviewed in *Int. Abst. Surg.* (1914), vol. 19, page 375.

MOUCHET, A (1937), "Traité de Chirurgie Orthopédique," Paris: edited by Ombredanne, L. and Mathieu, P.: Paris, *Masson et Cie*, vol. 3, page 2315.

MOUCHET, A., and SEILLE, G. (1949), *Pr. Med.*, vol. 57, page 197.

MURPHY, J. B. (1914), The Clinics of, vol. 3, page 369.

—— (1915), The Clinics of, vol. 4, page 1095.

—— (1916), The Clinics of, vol. 5, page 661.

PANAS, J. (1878), *Arch. Gen. Med.* (Paris), vol. 2, pages 5-22 (quoted by Hunt).

PATRICK, J. (1945), *J. Bone Jt. Surg.*, vol. 28, page 143.

PLATT, H. (1928), "The Robert Jones Birthday Volume." London, Humphry Milford, Oxford University Press, page 195.

RADLEY-SMITH, E. J. (1939), *Brit. J. Surg.*, vol. 25, page 785.

RAND, C. W. (1944), "The Neurosurgical Patient." Springfield, Charles C. Thomas, page 483.

WATSON-JONES, R. (1943), "Fractures and Joint Injuries." Edinburgh, E. and S. Livingstone, vol. 1, pages 145 6.

OCULAR PALSIES ASSOCIATED WITH GENERAL DISEASES.

By T. Keith Lyle.

London.

PARESIS or paralysis of one or more of the extrinsic ocular muscles may occur in a number of general diseases and in some cases an ocular palsy is the first symptom of such a disease.

Although diseases of the central nervous system are, as one would expect, more prone to be complicated by ocular palsies than are other conditions, there are many metabolic diseases in which such ocular complications not infrequently occur.

Diagnosis.

In most cases of ocular palsy the presenting symptom is diplopia. In rare instances this symptom is absent either because one eye (not necessarily the affected one) is relatively blind or because immediate mental suppression of the vision of one eye has occurred. In such instances the presenting symptom is "the deviation" or, if this is slight in degree, there may be no subjective symptoms, but merely an objective defect of ocular movement revealed on routine examination.

In some cases diplopia may occur only when the patient is fatigued, may be intermittent or variable and usually associated with ptosis, as in the early stages of myaesthenia gravis. Here, frequently, one muscle is involved and not necessarily the same muscle in each attack.

In other cases diplopia may occur in definite attacks associated with, or preceded by, severe unilateral headache (and sometimes typical visual disturbances), as in ophthalmoplegic migraine.

Sometimes diplopia may occur when the patient looks in a certain direction only, as in the slighter forms of paresis; in other cases the diplopia may be constant and obvious in all positions of the gaze, as in definite forms of paralysis.

In some instances diplopia may occur when viewing distant objects and not near ones, as in slight degrees of palsy of one or both lateral recti — a not uncommon finding when the abducent nerves are stretched in certain cases of raised intracranial pressure due to the presence of a space-occupying intra-cranial lesion.

Sometimes the patient has not noticed diplopia, but its presence has been demonstrated by his doctor. Although in some cases such a finding may be read and indicate the onset of a definite ocular palsy, the possibility of "physiological" or "introspective" diplopia must be borne in mind. It must also be remembered that it is quite possible to demonstrate diplopia at the junction of the binocular field with the uniocular field on either side, especially in a person in whom an appreciable degree of heterophoria exists.

Thus it will readily be understood that the mere fact that a patient suffers from diplopia means little in itself. It is a symptom which requires detailed investigation. If a patient complains of seeing double, it is necessary to obtain information on the following points:

(a) the nature of the diplopia, i.e., whether it is horizontal or vertical or a combination of both;

(b) the precise mode of onset of the diplopia, whether abrupt or slow and in what circumstances it began;

(c) the subsequent history of the diplopia, whether constant or intermittent; if constant, the variability in different directions of the gaze; if intermittent, the circumstances in which it occurs and the length of its duration.

Information should also be sought concerning the amelioration or worsening of the diplopia since its onset and the presence or absence of previous attacks.

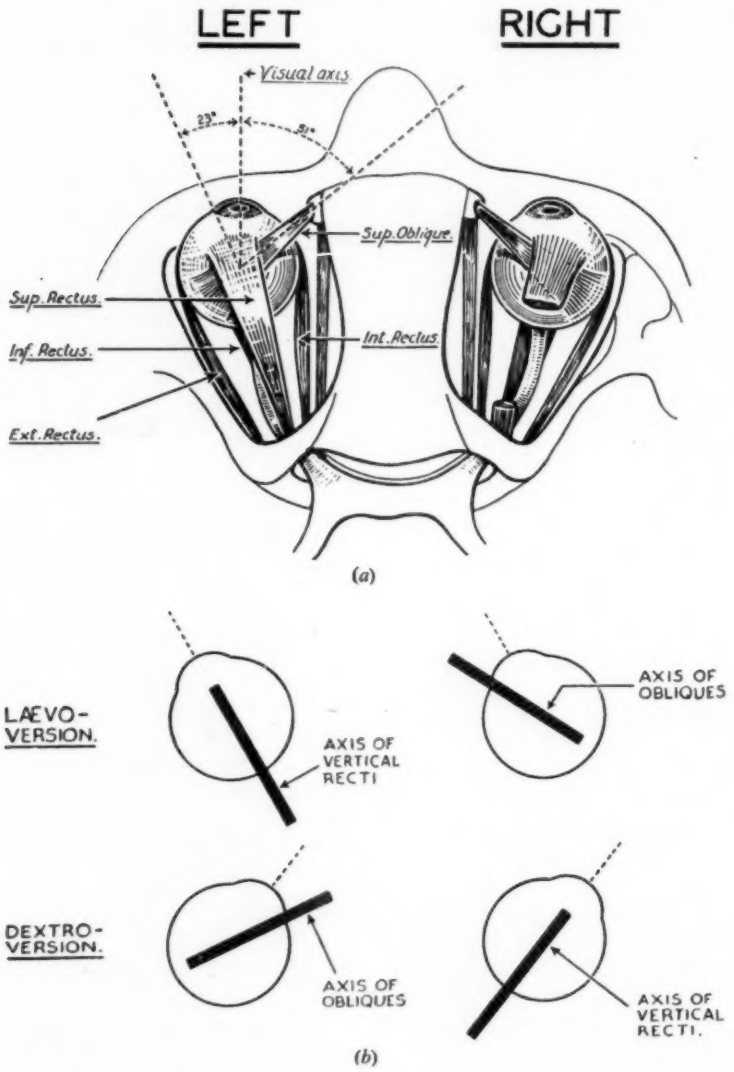


FIG. I.

If the patient is intelligent and observant, it is often possible to diagnose the particular ocular muscle at fault and, perhaps, to gain some idea of the possible aetiology by taking a careful history.

Although examination of ocular movements may clearly indicate the defective muscle, it may leave the clinician in some doubt especially if the lesion is slight or of long standing.

In the latter case the well-known sequelae complicate the clinical picture, and it may be difficult to determine whether the originally paretic muscle is the one primarily affected or whether it is its contra-lateral antagonist, e.g., it may be difficult to distinguish between a right or left lateral

rectus palsy or between a palsy of the right superior rectus and one of the left superior oblique. It is, therefore, desirable to rely upon examination of the diplopia.

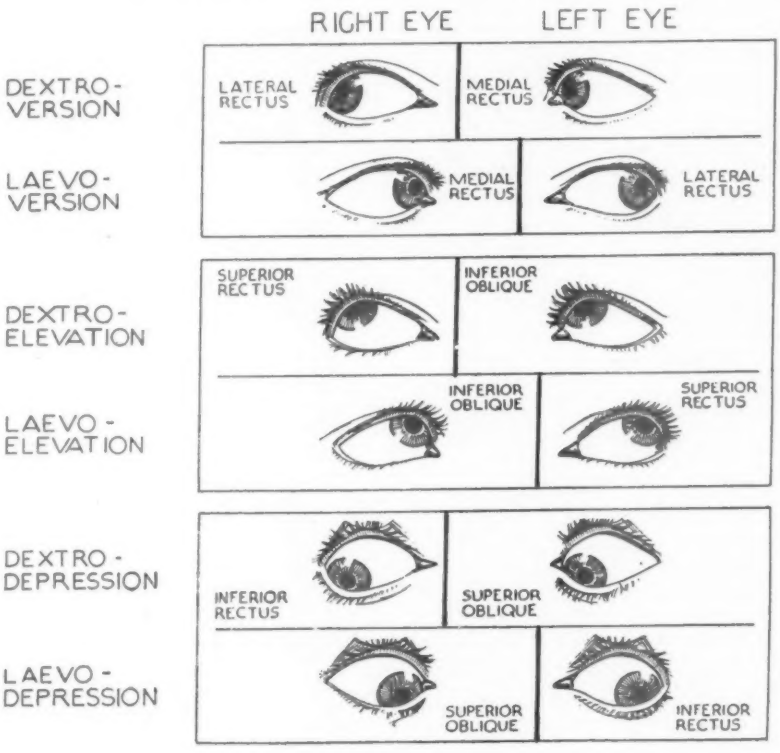


FIG. II.

This is essentially a matter of determining in which of the diagnostic positions of the gaze there is maximal separation of the two images. A knowledge of the action of the extrinsic ocular muscles (Figs. I and II) reveals which muscles are primarily concerned in producing this particular position. The additional information, readily obtained by the use of glasses of different colour in front of the two eyes (or by means of the cover test) reveals which image belongs to which eye, and in most cases leaves no doubt as to the diagnosis of the particular muscle involved.

Sometimes in palsies of long duration the diplopia test gives equivocal results due to the sequelae already mentioned. For instance, with a right superior rectus palsy the vertical separation of the images may be maximal and equal in degree both on dextro-elevation and dextro-depression; on dextro-elevation because of the primary paresis of the right superior rectus, and on dextro-depression because of the secondary paresis of its contra-lateral antagonist, the left superior oblique. Fig. IIIa shows diagramatically the sequelae in a case of paresis of the right lateral rectus, and Fig. IIIb the sequelae in a case of paresis of the left superior oblique.

In difficult cases valuable help may be obtained by the Hess screen test. One field is invariably smaller than the other and the smaller field always belongs to the eye with the primarily affected muscle. Also if the deflection corresponding to the primarily paretic muscle be added to the deflection

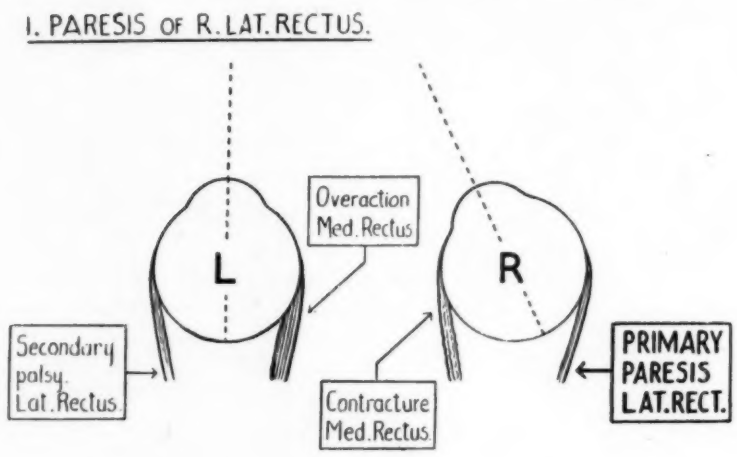


FIG. III A.

corresponding to its contra-lateral synergist, it will be greater than the sum of the deflections corresponding to the two antagonistic muscles.

Such difficulties in diagnosis, however, never occur in cases of recent origin.

AETIOLOGY AND TREATMENT.

These are most conveniently discussed from the anatomical standpoint.

A. *Supra-nuclear ocular palsy.*

Lesions affecting the descending supra-nuclear pathways from the cerebral cortex to the oculomotor nuclei result in paralysis of conjugate movements of both eyes, in contra-distinction to infra-nuclear lesions in which there is paralysis or paresis of the muscles supplied by one nerve. There is usually no squint or diplopia.

Paralysis of conjugate lateral movements of the eyes with preservation of vertical movements may occur when supra-nuclear pathways to the 6th cerebral nerve nuclei are involved, as in certain pontine lesions. The eyes cannot be moved laterally, although the medial recti may contract together on convergence. A unilateral supra-nuclear lesion of the 6th cerebral nerve nucleus will result in loss of lateral conjugate movement to one side only; this may occur in a sudden vascular hemiplegia due to a lesion of the internal capsule and the patient's eyes are deviated away from the side of the hemiplegia.

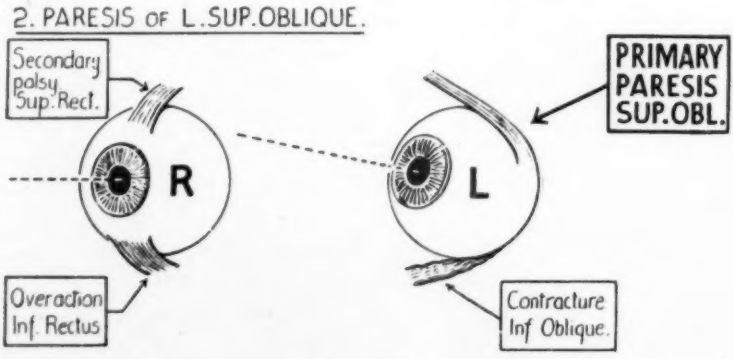


FIG. III B.

Supra-nuclear lesions of the 3rd cerebral nerve result in loss of vertical conjugate movement upwards with loss of convergence but with preservation of lateral conjugate movements. Tumours of the third ventricle, pineal body or mid-brain and inflammatory or vascular lesions of the mid-brain are the usual causes. Eyelid retraction or bilateral ptosis may occur. Pupillary abnormalities do not usually occur unless the nuclei themselves are simultaneously involved.

Dissociation of voluntary from reflex conjugate movement may occur, e.g., the patient may not be able to move his eyes voluntarily to either side, but lateral conjugate movement may be induced by turning the patient's head passively as he fixes his gaze on a stationary object directly in front of him.

There is one particular clinical entity which should be mentioned, i.e., dissociation of lateral conjugate movement, the commonest cause of which is disseminated sclerosis. On latero-version the lateral rectus of the abducting eye contracts fully, but the contra-lateral medial rectus fails to contract. The result is a divergent strabismus on latero-version with corresponding diplopia, but with parallelism of the visual axes in the primary position. The condition is often associated with nystagmus, which is more marked in the abducting eye.

B. *Nuclear ocular palsy. (Nuclear ophthalmoplegia).*

This condition may be partial or complete and is often asymmetrical in the two eyes with consequent diplopia. There is usually gross limitation of ocular movement with some degree of ptosis.

One of the less common causes of ocular palsy of nuclear origin is polio-encephalitis. This has been seen in a man aged 35 who had an illness associated with severe headache and diplopia due to a partial 3rd cerebral nerve palsy in which the ocular condition eventually cleared up completely in a space of six months.

Progressive nuclear ophthalmoplegia may occur at any age, but especially in middle age, and is sometimes associated with motor neurone disease (progressive muscular atrophy). It is slowly progressive and the pupils are unaffected.

A somewhat similar condition may be due to syphilis, but in this case the pupils are invariably abnormal and often inactive to light.

Myaesthenia gravis may cause a condition almost indistinguishable from that due to progressive nuclear ophthalmoplegia, the muscle weakness being localized to the ocular muscles with little or no evidence of myaesthenia in the limbs or bulbar muscles. The response to an injection of prostigmin invariably helps in the diagnosis.

Congenital defects of ocular movement may be due to aplasia of the oculomotor nuclei, but the history of its presence since birth leaves no doubt as to the diagnosis.

Treatment of supra-nuclear and nuclear palsies.

Although one naturally does not embark light-heartedly on treatment for cases in which a progressive lesion is present, it is quite possible in selected cases to afford a considerable measure of relief from diplopia by suitable adjustment of the ocular muscles.

Two cases of progressive nuclear ophthalmoplegia have been operated on by the author. One was an elderly woman who had constant vertical diplopia with a big torsional factor, one image being at an angle to the other. A recession of one inferior rectus and a tenotomy of one superior oblique overcame the vertical deviation and the torsion in the primary position and restored a fairly large field of binocular single vision, although there was still gross limitation of ocular movement in most directions of the gaze. It must be admitted that operation in this case was undertaken with some trepidation, but as it was quite impossible to correct the deviation by prisms and as she complained bitterly of being unable to read unless she occluded one eye, it was considered that operation at all events would not make matters worse. Fortunately she now reads binocularly. It is nearly a year since this operation and her condition appears to be stationary.

The other case which occurred was that of a man with a somewhat similar condition and the result of operation was equally satisfactory.

In congenital palsies of the nuclear type we usually find that there has been a constant strabismus from infancy and the surgical problem is largely one of attempting to improve the appearance. Recently a girl was seen whose ocular movements were confined to slight latero-version only. The eyes were depressed to about 35° and there was not a flicker of vertical movement either up or further down; also there was partial ptosis. The final result after a bilateral Blascoviz's operation on the eyelids, a free tenotomy of both inferior recti and a resection of both superior recti was cosmetically quite reasonable, although there was, of course, no improvement in the range of ocular movement.

C. *Infra-nuclear ocular palsy.*

This is due to a partial or complete lesion of one or more of the oculomotor nerves between the brain-stem and the orbit.

Ocular palsies may occur in acute inflammatory lesions of the brain or meninges in which case the main focus of attention is upon the patient's general condition, which may be critical and may prevent accurate examination of the oculo-motor function.

They may, however, occur in less acute inflammatory conditions or in more chronic inflammatory conditions when the main focus of attention is upon the disorder of oculo-motor function.

Cerebral nerve palsies of the 6th and partial palsies of the 3rd nerve are far commoner than those of the 4th in inflammatory lesions and the common causative factors are neuro-syphilis and disseminated sclerosis. Serological tests aid in diagnosis. In the former, the condition runs a more prolonged course and there are often other physical signs present, although ocular palsies may occur as isolated manifestations of meningo-vascular syphilis due to basal meningitis. In the latter there is a strong tendency to rapid improvement.

The author has seen a patient with bilateral 6th nerve palsy due to a localized meningitis following an operation for ethmoiditis. The paralysis cleared up completely in about six months.

Herpes zoster ophthalmicus is sometimes accompanied by a temporary 3rd nerve palsy. There are also certain cases of 6th nerve palsy which are of obscure aetiology just as with certain cases of 7th nerve palsy. Some consider that these cases are all due to disseminated sclerosis and no doubt a large percentage of them are, because, if carefully followed, a number of them develop certain classical signs of that disease at a later date--sometimes several years later. On the other hand, there are a number of cases in which no further symptoms of neurological disease occur.

Palsy of the 6th nerve, due to spread of infection from the petrous portion of the temporal bone as a complication of middle-ear disease, constituting part of the syndrome described by Gradenigo, is a well-known though not very common condition and the prognosis is usually good.

There is also a condition known as orbital periostitis, with involvement, usually, of all three nerves and also of the first division of the 5th nerve on one side. It is thought to be due to periostitis of the sphenoidal fissure and is sometimes known as the sphenoidal fissure syndrome. The condition usually improves, but does not clear up completely.

Just as any peripheral nerve may be affected by peripheral neuritis, so may the ocular motor nerves, and there are many causes of such a condition. Examples occur with diabetes and sometimes certain poisons or toxins.

Treatment of infra-nuclear palsies.

In all these cases spontaneous recovery usually occurs. There are, however, certain instances of 6th or partial 3rd nerve palsy in which the condition has remained stationary for many months and which are suitable for surgical treatment.

The following is an example of a case in which some measure of spontaneous recovery had occurred, but insufficient for ocular comfort:

L.A.C. G.D., 25 years. R.A.F. Regiment in the Western Desert. Four years previously he had had a febrile illness in which he suffered horizontal

diplopia of sudden onset. At first it was constant, then it improved to the extent of his being able to see single for near objects, but not for distance, and, finally, he was able to obtain constant binocular vision by the adoption of a compensatory head position, namely that of depression of the chin.

This consequent inability to stand to attention attracted the attention of his Flight Sergeant, who, discovering that the man could not "see straight" if he held his head up, suggested that it would be advisable for him to report sick.

The lapse of four years had resulted in the deviation becoming almost concomitant and the ophthalmologist to whom he was referred failed to find obvious signs of an ocular palsy, and so reached the erroneous conclusion that the man was either hysterical or a malingerer. However, before actually referring him to the psychiatrist he sent the patient for a whole series of investigations, clinical and serological, which all proved negative. A final diagnosis of hysteria was arrived at and the patient recommended to be invalided to the United Kingdom.

On going into the history there was little doubt that there was originally a left lateral rectus palsy. Examination on the Hess screen gave corroborative evidence. The abnormal head posture was quite clearly adopted to overcome the diplopia and is one that is sometimes met with in cases of lateral rectus palsy. Depression of the chin causes relative elevation of the gaze with consequent slight divergence — quite enough to overcome a convergent deviation of slight degree and to convert the esotropia of 20° into an esophoria of 10°.

Operation (bilateral medial rectus recession) resulted in disappearance of the diplopia. The man returned to his unit and was able to stand to attention.

D. *Vascular conditions.*

The commonest vascular conditions to cause infra-nuclear cerebral nerve palsies, involving the 3rd, 4th or 6th nerves, are aneurysms. These may cause palsy by pressure upon one or more of the ocular motor nerves or may cause involvement of the nerves by haemorrhage due to rupture.

In arteriosclerosis of the vessels in the neighbourhood of the circle of Willis, ocular palsy may be caused by direct pressure upon a nerve by a thickened artery. Whether this explanation is sufficient to explain the common occurrence in elderly arteriosclerotic patients of 6th, or more rarely 4th, nerve palsies which so frequently undergo spontaneous recovery, is difficult to say, but it is, at all events, a reasonable one.

In the vascular group may be included those cases of ocular palsy which sometimes occur in cases of migraine and are probably due to intra-cranial aneurysms, the so-called *migraine ophthalmoplegique.* This may take the form of recurrent ocular palsy associated with headache, with complete recovery between attacks; or a permanent ocular palsy may occur.

A typical case was the following:

Mrs. M.P., 34 years. Eighteen months previously she woke up one morning to find she was seeing double. There was vertical and horizontal separation of the images. The condition had remained unchanged. She had suffered from migraine for many years, the attacks being severe and consisting of unilateral headache, usually right-sided, with positive ocular phenomena. She had a partial right 3rd nerve lesion, mainly involving the inferior and medial recti, with a constant vertical strabismus. In the primary position the Maddox Rod test showed:

F.R.E. R/L 11° and EXO 22°
F.L.E. R/L 17° and EXO 20°

An operation was planned with a view to weakening the two contra-lateral synergists of the primarily paretic muscles, i.e., the left lateral rectus and the left superior oblique, the former by recession and the latter by partial tenotomy. The contra-lateral antagonist of the primarily paretic right medial rectus, i.e., the left medial rectus, was strengthened by recession.

As a result of this, binocular single vision was restored in the primary position and a reasonably large field of binocular single vision obtained. There was, however, esophoria of 6° in the primary position and the patient saw double looking to the left — in short, the correction was a little overdone. A small recession of the right medial rectus, however, overcame the residual angle of deviation with a satisfactory improvement in the field of binocular single vision and the disappearance of diplopia.

One would not, of course, have suggested operation in a case of this sort in the early stages. Operation is not justifiable unless it appears to be reasonably certain that the condition is stationary.

E. *Neoplasms.*

An intra-cranial tumour can cause direct compression of one or other of the ocular motor nerves. A typical example of such a tumour is a meningioma in the neighbourhood of the sphenoidal ridge which may compress one or other of these nerves.

Increased intra-cranial pressure with consequent distortion of the brain may result in 6th nerve palsy in one or both sides — a false localizing sign since the nerve involved may have little relation to the position of the tumour.

Carcinoma of the naso-pharynx may spread upwards and inside the floor of the skull, with involvement of several cerebral nerves on one side, usually commencing with the 6th or perhaps the 5th.

The author has recently seen a patient in which a right 6th cerebral nerve lesion was the first symptom of a carcinoma of a pituitary rest in the middle fossa of the skull. Subsequently other cerebral nerve palsies occurred.

F. *Congenital conditions.*

Infants born with slight degrees of ocular palsy, involving one or more muscles, tend to compensate for the anomaly often by (a) the adoption of a compensatory head posture and (b) by mental suppression of one image when looking in that direction of the gaze in which the deviation of the visual axes occurs.

Such compensation sometimes tends to break down in middle adult life with the onset of diplopia and cases of this sort are sometimes mistaken for those due to diseases of the central nervous system.

The following table serves to show the main points in the differential diagnosis:

PALSY OF A VERTICALLY ACTING EXTRINSIC OCULAR MUSCLE OCCURRING IN AN ADULT.

Differential diagnosis of those of congenital origin with symptoms of decompensation and those of acquired origin.

	Congenital origin becoming decompensated.	Acquired origin.
	N.B. — In children, and in adults, where compensation exists, there are usually no subjective symptoms. The abnormal head posture, or the abnormal ocular posture on latero-version may attract the attention of parents or other observers.	
Onset of symptoms	Usually indefinite and intermittent.	Usually definite and sudden.
Symptoms	1. Intermittent diplopia and/or 2. Difficulty in focussing and/or 3. Preference for reading with one eye closed.	Diplopia (in all or only in certain directions of the gaze).
Abnormal head posture	Usually present, but patient is usually unaware of it, unless others have drawn his attention to it.	May be present; if so, the patient is usually aware of it.
Vertebral column	Scoliosis with anatomical changes invariably present.	No anatomical changes present.
Angle of latent deviation	May be large and yet the resulting symptoms may be slight.	May be small and yet the resulting symptoms may be pronounced.
Suppression	Suppression affects one eye in the ocular posture in which the affected muscle has its main action, usually absent in the primary position.	Suppression absent at first, but may occur later.
Angle of secondary deviation	Usually only slightly greater than that of the primary deviation, i.e., deviation tends to be concomitant.	Usually much greater than that of the primary deviation, i.e., deviation tends to be non-concomitant.

G. Conditions affecting the ocular muscles.

The two chief diseases which may primarily affect the extrinsic ocular muscles are myasthenia gravis and exophthalmic ophthalmoplegia.

The diagnosis of myasthenia gravis is not usually difficult if a careful history is taken and clinical examination made, and if a test is carried out with prostigmin. Obviously cases with this aetiology are not suitable for surgical treatment of the extrinsic ocular muscles because of the variability of the condition and the probability of exacerbations and remissions.

Ocular palsies in exophthalmic ophthalmoplegia, on the other hand, are readily amenable to surgical treatment, provided the general condition is stable.

Cases of exophthalmic ophthalmoplegia are interesting, in that their initial diagnosis is often in doubt. They are sometimes diagnosed as space-occupying orbital lesions and often go untreated for years.

A case in point was that of Miss B., 40 years, who twelve years previously had noticed that her right eye began to be getting prominent and that she was seeing double. She was admitted at that time to one of the London teaching hospitals, where a thorough investigation was carried out to find the cause for her ocular symptoms. Every conceivably relevant test was done, including estimation of the basal metabolic rate. In the end a tentative diagnosis of an orbital tumour was made, but, for some reason or other, operation was not undertaken.

As time went on, the condition at first became a little worse, but later became stationary. She wore a frosted lens in front of the right eye, but found it a great embarrassment because she was a school teacher.

She had a proptosis of the right eye and upper lid retraction with a gross defect of elevation due to paralysis of the right superior rectus. In the primary position, with the left eye fixing, there was 37° of left hypertropia, and with the right eye fixing, there was too much suppression for movement.

The operative procedure adopted was:

1. Resection of the right superior rectus.
2. Recession of the right inferior rectus.
3. Myectomy of the left inferior oblique.

This resulted in a marked improvement in her condition with the restoration of a useful field of binocular single vision.

Another case of exophthalmic ophthalmoplegia was that of Mrs. F., who had been treated for thyrotoxicosis by means of a partial thyroidectomy some twelve years previously with satisfactory improvement in her general health, but the diplopia which occurred at that time had remained stationary.

She had a right superior rectus palsy. Incidentally, it is interesting to note that in exophthalmic ophthalmoplegia the superior rectus is more commonly involved than any other muscle. She was able to enjoy binocular vision when looking downwards, although it was necessary to occlude the right eye when looking straight ahead or in the distance.

She was operated on in one stage, i.e., resection of the affected right superior rectus. Myectomy of the left inferior oblique had been planned, but the patient refused to have her unaffected (left) eye operated upon. However, the result was very successful and the field of binocular vision one year later was so good that the same procedure has been adopted since. It appears that if the paresis is a primary affection of muscle, as it appears to be in exophthalmic ophthalmoplegia, there is far less over-action of the contra-lateral synergist and, therefore, the result of weakening the contra-lateral synergist is less than the result of strengthening the primary weak muscle.

CONCLUSION.

The subject of ocular palsy is a fascinating and complicated one and there are numerous causes so that each case requires detailed investigation in order to determine the muscle or muscles at fault and then to discover the aetiological cause of the palsy before deciding upon the best line of treatment.

HYPOSPADIAS.

By K. B. Fraser.

Brisbane.

Introduction.

THE many different methods employed in forming a new urethra in patients with hypospadias are themselves an indication of the inherent difficulties that lie in the way of a satisfactory result.

Certainly my own path in this type of surgery has been a thorny one, beset by difficulties and disappointments. I have tried quite a number of different methods of dealing with the problem until I have come, by trial and error, to the method which I now use to the exclusion of all others. No doubt other techniques have proved as satisfactory or more satisfactory in other hands, but the method to be described here seems to me to have certain advantages over all others.

I will deal particularly with mid-scrotal hypospadias, as in my experience cases of any worse degree than this are not amenable to surgical treatment, while the technique employed in mid-scrotal cases can be equally well employed for less severe grades of the deformity.

The aims of the operation are twofold: (1) To provide a urethra that will allow of normal urination; (2) To provide a penis that will subsequently allow of normal coitus.

The requirements to fulfil these aims are:

(a) A straight penis.

(b) A urethral opening far enough forward on the penis.

(c) A urethra that will allow a full urinary stream without spraying or dribbling.

Certain principles are involved in fulfilling these requirements.

(i) Thorough correction of the chordee is only possible by extensive dissection and the use of a preputial flap to cover the ventral surface of the penis.

(ii) The urinary stream must be by-passed before any attempt is made to reconstitute the urethra.

(iii) Small doses of sulphacetamide and mild acidification of the urine will prevent respectively urinary tract infection and calculus formation or phosphatic concretions on the self-retaining catheter.

(iv) Only skin which does not bear hair should be used for the new urethra.

(v) The new urethra should be formed from skin in continuity, thus avoiding any suture line uniting the old urethra with its new extension.

(vi) At every stage the newly formed urethra should be buried quite deeply to minimise the risk of fistula formation.

(vii) Care must be taken to see that haemostasis is secured and that no raw surface or dead space is left at the completion of any stage.

(viii) The newly formed urethra should be sufficiently commodious to do away with the necessity for any subsequent dilatation.

(ix) While it is necessary to bring the new urethra right up to the fraenum, it is not essential to bring it through the glans to an opening at the normal site.

(x) The use of penicillin during the immediate postoperative period is necessary to make primary union more certain.

The method to be described fulfils all these desiderata, and is modelled broadly on that described by Cabot (1936), but a number of modifications have been incorporated.

The Technique of the Operation.

In order to try and simplify the account of the technique, sketches representing the various stages were made in the theatre during the progress of the operations, and these sketches were later converted into coloured drawings.

It is well known that every case of mid-scrotal hypospadias has a marked chordee which needs early correction, and if this is not effectively dealt with, all further procedures will be more or less abortive.

The Preliminary Operation: The Correction of the Chordee.

This is generally done about the age of two or three years, but if the parts are very small it may be advisable to wait longer. A transverse incision is made on the ventral surface of the penis at the point of maximal ventral curvature. All the fibrous tissue between the corpora cavernosa is meticulously dissected out; when this is done the penis can be hyperextended and a wide raw area extending back to the peno-scrotal junction occupies the undersurface of the penis. Where the urethral opening is mid-penile, this dissection involves undermining the urethra, and as a result the urethral orifice slips back to the peno-scrotal junction.

An incision is then made along the mucous layer of the prepuce one millimetre from the coronal attachment of the prepuce. The two layers of the prepuce are separated and on each side a longitudinal incision through the mucosal layer allows it to be unfolded; the resultant rectangular flap is held forward over the dorsal surface of the glans by two temporary sutures. The dissection between the two layers of the prepuce must be thorough so that no transverse ridge remains at the junction of the mucosal and skin layers. A short incision on each side of the penis joins the dorsal and ventral raw surfaces. A transverse slit is made in the preputial flap and the head of the penis is threaded through this opening. The distal part of the flap, composed entirely or almost entirely of the original mucosal layer of the prepuce, now lies on the ventral surface of the penis where it is stitched into position to cover the raw surface there. The two raw edges opposed to each other around the glans are then sutured. Finally the penis is held back on to the abdominal wall by two temporary sutures during the healing stage.

FIG. I. A Duplay flap outlined along each side of the mid-line depression on the scrotum.

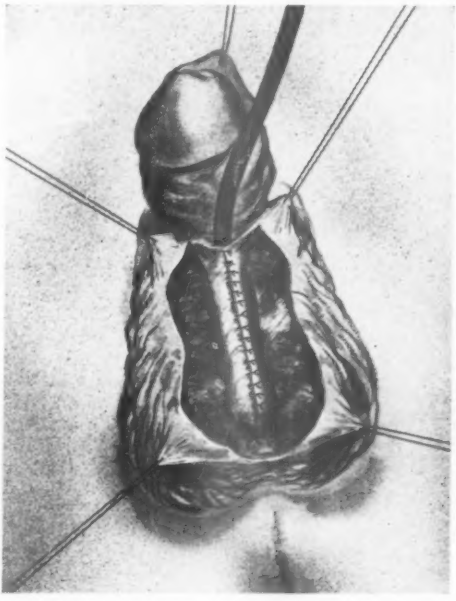


FIG. II. The new urethra completed up to the peno-scrotal junction.

No further operative procedures are carried out until nine or ten years of age.

THE OPERATION PROPER.

Stage 1. The formation of a new urethra from the mid-scrotal opening to the peno-scrotal junction.

A preliminary suprapubic cystostomy is done to by-pass the urinary stream and the repair is carried out a week later. A Duplay

flap is marked out on the scrotum commencing at the peno-scrotal junction and passing round the urethral opening. (Fig. I.)

In cases of mid-scrotal hypospadias the scrotum is always bifid and the skin lying in the mid-line depression and delineated by this flap is always devoid of hair. The flap is partially dissected up and inverted to form the new urethra over a size 3 (English) rubber catheter which is inserted, a short distance only, into the existing urethra. (Fig. II.) The edges of the new urethra are united with interrupted sutures of 000000 catgut on an eyeless needle. Great care is taken to see that these sutures do not pass actually through the epidermis, but only pick up fascia and corium. The flap has to be wider than one would expect in order that the edges may come together over the catheter without tension. After being dissected up, it is remarkable how much smaller the flap looks than the area originally marked. The free edges of scrotal skin and fascia on each side are now undermined. First the fascial edges are united over the new urethra and then the skin edges are brought together, using fine silk on eyeless needles. (Fig. III.)

FIG. III. The edges of scrotal fascia and skin united over the new urethra.

This manoeuvre buries the new urethra deeply and eliminates the appearance of a bifid scrotum. Great care is taken to secure haemostasis and to avoid any dead space.

After the wound is finally healed the suprapubic tube is removed and within a few days the patient is passing urine freely through the new urethra and the suprapubic wound has closed.

Stage 2. Formation of the new urethra from the peno-scrotal junction to the frenum and anchoring of the penis down to the scrotum.

Some three months are allowed to elapse after the previous operation. Then the suprapubic tube is re-inserted and a week later the longest and most important step in the operation is carried out. In the same way as before, a wide Duplay flap is marked out on the ventral surface of the penis, curving round the urethral orifice at the peno-scrotal junction. This flap must be made to pass forward on the penis as far as possible. Again the flap is partially dissected up and the edges inverted and brought

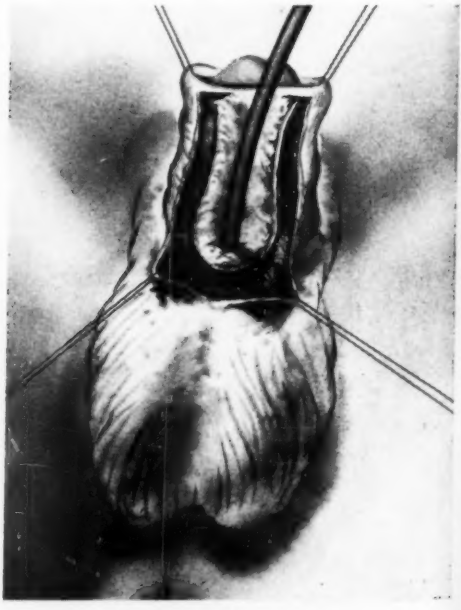


FIG. IV. Mobilisation of the Duplay flap on the ventral surface of the penis.

together over a No. 3 (English) rubber catheter inserted a short distance into the urethra. If the original chordee operation has been done correctly, the skin of this flap will be composed entirely or almost entirely of the original preputial mucosal surface. The preputial epithelium so employed carries no hair. (Fig. IV.) Particular care is taken to make this flap wide enough, as there is a great tendency to have it too narrow at its distal extremity. When the new urethra has been completed to the fraenum a longitudinal incision is made in the mid-line of the scrotum. This passes down from the peno-scrotal junction for a distance equal to the length of the penis, and at its extremity on the scrotum a short transverse incision

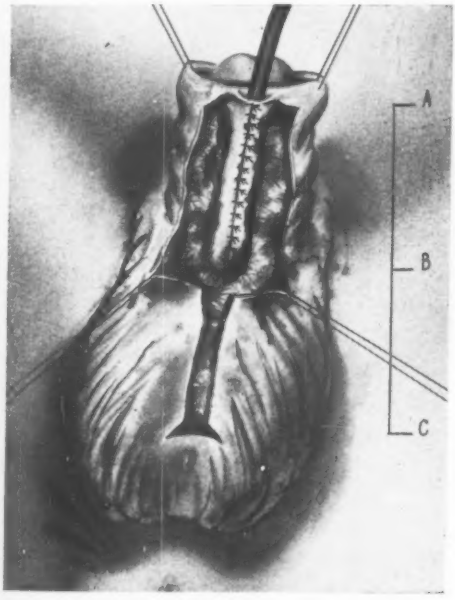


FIG. V. Completion of the new penile urethra and preparation of the raw area on the scrotum for reception of the ventral surface of the penis.

is made. (Fig. V.) The skin edges of this scrotal incision are undermined for a short distance, but care must be taken not to open up these loose tissues too freely on account of the danger of a subsequent dead space. The penis is then folded ventrally on to the scrotum, swinging, as it were, on a hinge at the level of the peno-scrotal junction. This brings the raw surface of the penis with its newly formed penile urethra into apposition with the raw surface on the scrotum. The raw edges of the penile skin are everted and brought into apposition with the everted edges of the scrotal incision, raw surface thus approximating to raw surface. This is effected by passing interrupted silk sutures over two pieces of fine rubber tubing on

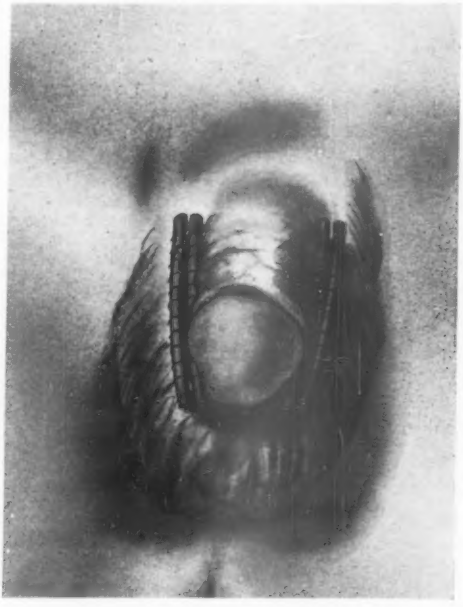


FIG. VI. The penis anchored to the scrotum in the acutely flexed position.

each side. (Fig. VI.) In the region of the fraenum the skin of the penis must be brought into apposition with scrotal skin, thus protecting the extremity of the new urethra and leaving no raw area. This manoeuvre of folding over the penis on to the scrotum is a modification of the Bucknall and Winsbury White operations. In ten days the stitches and rubber side tubes are removed, if necessary under an anaesthetic, but the catheter in the urethra and the suprapubic tube are left in situ. It is remarkable how quickly the scar line flattens out after removal of the sutures.

Stage 3. Lifting the penis from the scrotum.

Three weeks after the last operation the final stage is entered upon. An incision is carried down the scrotum on each side of the penis. These incisions curve medially to

meet in the mid-line below the tip of the penis where it is bound down to the scrotum. (Fig. VII.) The scrotal flaps are dissected up towards the mid-line until the whole penis

FIG. VII. Indicating the line of incision for the scrotal flaps.

with its new urethra is dissected off the scrotum as far back as the line of the peno-scrotal junction. In carrying out this dissection the position of the urethra should be constantly checked by feeling for the in-dwelling catheter; in this way one can avoid nicking the urethra with the inevitability of a resulting fistula.

The two flaps of the scrotal skin which have been dissected off the scrotum, together with the penis and urethra, are now folded over and sutured together on the ventral surface of the penis. (Fig. VIII.) These scrotal flaps must be made wide enough to come together without tension. Finally the raw edges of the scrotum are approximated. Ten days later the stitches are taken out, the suprapubic tube is removed and the small catheter in the urethra is also taken out. Urinary control is regained very quickly and the suprapubic wound is closed within a week.

DISADVANTAGES AND ADVANTAGES OF THE OPERATION.

Disadvantages.

1. A number of operations and a long time are necessary to complete the repair. In regard to this, medication pre-operatively overcomes the apprehension of repeated anaesthetics and the length of time taken is a small price to pay for an efficiently functioning urethra.

2. It is necessary to carry out a second suprapubic cystostomy. It is fortunate that children tolerate this tube very well, and no trouble in the way of urinary tract infection or calculus formation has been experienced.

FIG. VIII. The penis has been lifted off the scrotum and the flaps of scrotal skin are shown united over the preformed penile urethra.

3. The making of a Duplay flap tends to leave a small *cul de sac* where the new urethra meets the old. This may necessitate the use of a silver catheter to fill the bladder prior to the second cystostomy, but no real difficulty has been experienced in this connection.

4. The cosmetic result is not perfect. Admittedly the resultant penis may not be aesthetic, but it is straight and sturdy with a mobile and loose skin covering.

Advantages.

1. If the technique is correctly carried out, the chances of initial success at every stage are remarkably good.

2. The urethral orifice is far enough forward for all practical purposes.

3. The method does not involve any interference with the corpora cavernosa or the glans, and the risk of serious haemorrhage is minimal.

4. The urethra is well covered and is of a satisfactorily wide calibre which requires no dilatation.

5. It is reasonable to suppose that there are no hair follicles in the skin which is used for the new urethra.

6. The new urethra is composed of skin in continuity. This is not the case with inlay grafts in which there must always be a suture line at the junction of the old and new components of the urethra. The presence of such a junction line is one of the most fruitful sources of trouble whenever inlay grafts are employed.

Finally, in coming to a decision as to the relative suitability of any given technique one must not place too much emphasis on the time factor, but must weigh the importance of successful results against previous disappointments which may have been experienced with other methods. Denis Browne in London is using a method which it is claimed is quicker and in a sense simpler than that described here. The publication of his results and the methods employed to achieve them are looked forward to with interest.

DISCUSSION.

Of 4 recently completed cases, 3 were pseudo-hermaphrodites each with a mid-scrotal urethral orifice, a deep mid-line cleft in the scrotum and a small acutely flexed penis. Three of them, aged 9, 8 and 9 respectively, had to have an operation for cure of chordee with a preputial flap before the formation of the urethra could be commenced. Subsequently each had his urethra fashioned as outlined in the text, and no trouble was experienced at any stage. Strangely enough the fourth case, which gave a great deal of trouble, had the least severe deformity, as he commenced with a urethra that opened about one-third of the way up the penis. The chordee in this case was corrected by the old method of a transverse incision sewn up longitudinally, and after this was done the urethral opening had moved back almost to the scrotum. Subsequently an attempt was made to build up the penile urethra with a Duplay flap covered by mobilised penile skin from each side. Not only was this a complete failure owing to faulty cutting of the flap, but, worse still, a small urethral fistula was left. This was successfully closed by the method of Davis, leaving a urethra intact to the peno-scrotal junction. At this stage it was decided to revert to the standardized technique, and stages two and three were attempted. This time a haemotoma caused a complete breakdown. A further attempt was made some months later, and this time everything went according to plan.

The difficulties encountered in this case were due simply to faulty technique and not to any inherant shortcomings in the rationale of the operation.

Excluding cure of chordee, the numbers of anaesthetics given were seven, nine, six, and, in the unfortunate case, fifteen. Quite a number of general anesthetics were given which could have been avoided. These included anaesthetics for removal of sutures, removal of suprapubic tubes and passage of sounds. Experience has shown that there is no necessity to pass sounds at any stage. The time in hospital for the first stage averaged thirty-one days. The time in hospital for the second and third stages averaged sixty days. These periods were prolonged by operative postponements on account of respiratory tract infections and delays before being taken home to country centres. The interval between stages 2 and 3 averaged twenty-six days, during which time the patient remained in hospital with the suprapubic tube in situ.

In each of the four cases the penis is satisfactorily straight and the urethral opening is well forward in the vicinity of the frenum. (Fig. IX.) There is inevitably a rough appearance of the penile skin on the ventral aspect, containing, as it does, quite a considerable amount of scrotal skin, but the skin is loose and mobile, without obvious scarring.

The urinary stream in each case is full and forceful and urination in the erect posture approximates to normal. (Fig. IX.)

ADDENDUM.

Since this article was written, another case of peno-scrotal hypospadias in a boy of 9 years has been completed, using the same technique, with a result comparable to that in the previous cases. Four anaesthetics only were required and the stay in hospital was forty-one days.

REFERENCE.

CABOT, H. (1936), *New Engl. J. Med.*, vol. 214, page 871.

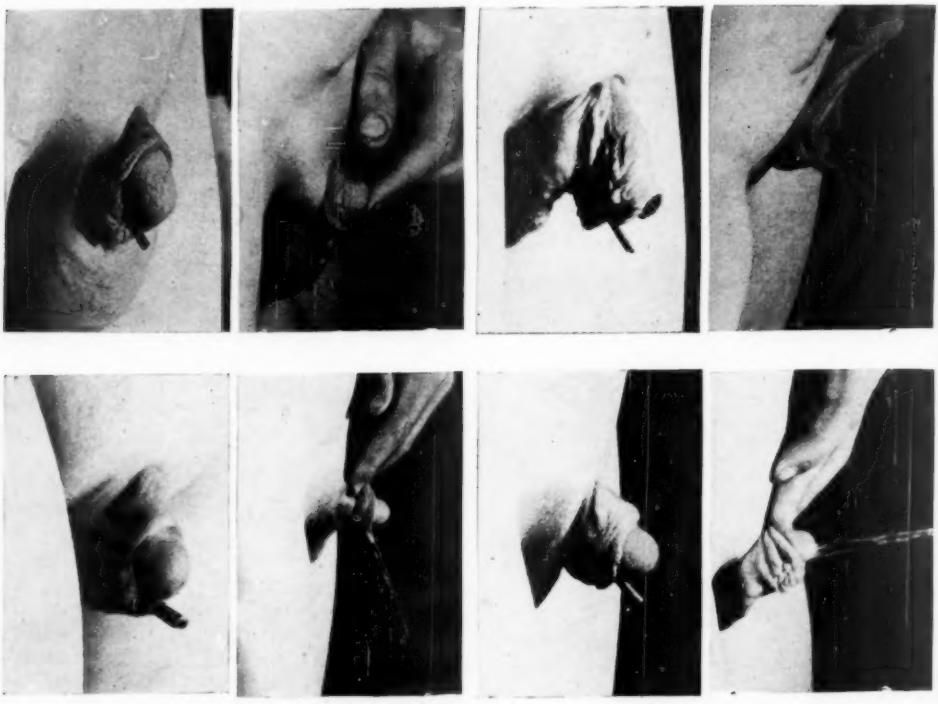


FIG. IX. The post-operative result in the four cases mentioned in the text.

SURGERY OF THE INFERIOR OBLIQUE AT ITS SCLERAL INSERTION.

By Clifford Colvin.
Orange.

Introduction.

FOR the past fifteen years the author, in dealing with the inferior oblique muscle, has used a technique consisting essentially of tenotomy and recession of the muscle at its insertion which is considered a more rational procedure than cutting a piece out of the muscle itself. In other operations for squint the tendon is severed and not the belly of the muscle; it was, therefore, considered that the same rule should apply to the inferior oblique.

Anatomy.

The true action of the inferior oblique muscle is still in doubt. The orthodox teaching is that it acts as an external rotator. Variations in its insertion are only second in frequency to those of the superior oblique, and it is possible that many of the apparently obscure actions of these muscles may be due to variations of their insertions.

There is practically no tendon to the inferior oblique. It is a round worm-like muscle and is practically all muscle fibre to its insertion into the sclera under cover of the lower border of the lateral rectus. Numerous diagrams portray the muscle with a broad tendon like that of the lateral rectus, but in the author's experience such is not the case. The inferior oblique muscle has the longest and strongest check ligament in the orbit. The insertion of the inferior oblique muscle is rather constant in its location and is often used as a guide in retinal detachment operations. The muscle fibres are inserted directly into the sclera on the horizontal meridian of the globe, making a right angle with the external rectus muscle. The line of insertion is about 10 mm. long and in normal eyes its centre is 2.2 mm. from the spot corresponding to the fovea and 5.2 mm. from the optic nerve. The inferior oblique is inserted posterior and lateral to the inferior pair of vortex veins, so it is always wise to be on the look out for the vortex vein and take care not to damage it, though I have found this not very likely. The inferior oblique is innervated by the 3rd nerve — Bing and Whitnall express agreement that there is probably some degree of bilateral innervation.

The inferior oblique acts as an elevator which increases as the eye turns inwards and decreases as the eye turns outwards. It acts as an extorter. The inferior oblique is the muscle least frequently involved in paralysis and then is often accompanied by internal ophthalmoplegia—limitation of movement and vertical diplopia are greatest when the eye is turned up and in. The false image representing the inferior oblique muscle leans to the affected side. Volkmann states "that the plane of the inferior oblique muscle actually passes anterior to the vertical axis." If this is true, in contraction the muscle will internally rotate the eye.

The Operation.

The operation consists essentially of tenotomy and recession of the inferior oblique at its insertion into the globe.

It can be done under local or general anaesthesia; if local anaesthesia is used, a retro-bulbar injection is necessary and some local infiltration around the lateral rectus and the inferior oblique as well. For children I prefer a general anaesthetic; for adults, local works well.

A control suture is inserted near the limbus at 9 o'clock and used to roll the eye over medially. An incision is then made through the conjunctiva along the lower border of the lateral rectus curving slightly downwards and backwards. The lateral rectus is then defined and hooked up with a squint hook. One or two sling sutures are then run underneath this muscle and held with forceps. The lateral rectus is then pulled upwards, and beneath its lower border a squint hook is inserted and the

inferior oblique picked up as it emerges through Tenon's capsule; it is then dissected out and any expansions trimmed off for a centimetre from its insertion. A slight tug on the squint hook will show the line of the belly of the muscle. If a tenotomy is to be done, the muscle is then tensed, cut close to its insertion and then let go. If a recession is to be done, the line of the muscle is carefully noted. A double-armed atraumatic suture is then used, each needle being inserted at the margins of the muscle into the sclera and the suture left loose over the muscle. The muscle is then removed from its insertion, having first been clamped with a Princes' forceps. The muscle is allowed to slide back and the needles put through it, thus anchoring it to the new position on the sclera. The needles are then carried through the conjunctiva, tied and left long. The suture is removed from round the external rectus and the wound closed with interrupted silk sutures. The guide stitch is then removed, the eye is irrigated with saline and penicillin 1000 units per c.c., is instilled and both eyes bandaged probably for four days, but longer if deemed necessary.

Recession of the medial recti for convergent squint is performed in a similar fashion, following the technique taught to me by Harrison Butler in 1928.

The two needles inserted through the sclera give a better spread to the attachment of the muscle.

CASE REPORTS.

Case 1.

Tenotomy. I.P., female, aged 15, had a right eye which turned up and out. She had a divergence of about 10° constantly, but on looking to the right the eye went up and out about 30°. Her vision in the right eye was 6/9 partly and in the left 6/6 partly. A tenotomy at the insertion was performed under local anaesthesia (without a retro-bulbar injection) on 30th May, 1935. After operation she developed some diplopia, but gradually got fusion and the diplopia practically disappeared by December. Her vision in June, 1936, was R.E. = 6/9, L.E. = 6/6. Since then she has not been seen by us. Dr. Frank Flynn originally examined this patient with me.

Case 2.

Tenotomy. D.C., female, aged 18. R.E. = 6/6, L.E. = 6/6 partly divergent strabismus up and out — Fixes mainly with R.E. No. S.M.P. at –30 –30. Under general anaesthesia tenotomy of the inferior oblique at the insertion and recession of the left lateral rectus on 9th September, 1948. After operation No. S.M.P. Crosses at –5 to –7. On 28th September a recession of the right lateral rectus was performed. On 7th October S.M.P. at –10 –10 and hyperphoria 6°. On 20th October there appeared to be false prejection L.E. On 26th October S.M.P. occasionally at –5–. On 20:h November fusion at 0–0. On 14th December 0 to –5 fusion.

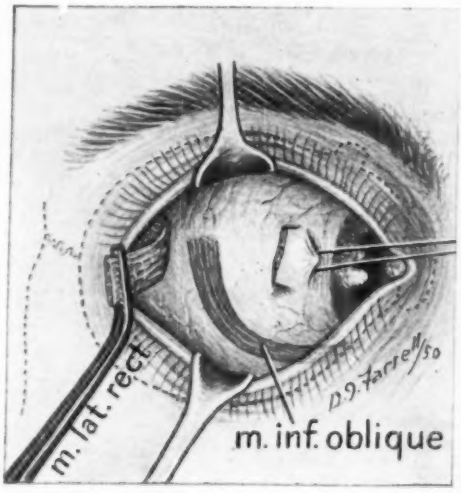


FIG. I. Anatomy of the inferior oblique muscle. The lateral rectus muscle has been cut and reflected to show the insertion of the inferior oblique. The dotted line indicates the outline of the bony orbit.

Case 3.

Tenotomy. D.W., male aged 4. Alternating convergent strabismus since 8 months old. On looking laterally to each side the opposite eye looks up and in markedly. Under general anaesthesia a tenotomy at the insertion of left inferior oblique was performed by me on 5th February, 1938. On 24th February K. B. Armstrong did a tenotomy of the right inferior oblique and a recession of the left internal rectus. Later, on 25th April, a recession of the right internal rectus was performed. Training on the synoptophore was attempted. In 1946 he had less than 10° convergence and S.M.P., but no fusion, but the cosmetic result was good.

Case 4.

J.G., male, aged 6. Alternating strabismus R.E. = 6/6, L.E. = 6/6 nearly. No. S.M.P.– convergence 25 overaction inferior oblique 10°. On 3rd May, 1949, recession of right inferior oblique by K. B. Redmond. Recession of left medial rectus on 17th May, 1949. On 27th May, 1949, eyes look straight. S.M.P. and good movement of eye right and left on 3rd June, 1949.

Case 5.

P., married female. Diplopia 2½ years. Paresis right superior oblique and left inferior rectus. Recession right inferior oblique. After operation

fuses at 15-20 right and left 2°. Paresis left lateral rectus. Area of binocular vision improved, gave up frosted glass. Six months later has now developed a paresis of left lateral rectus.

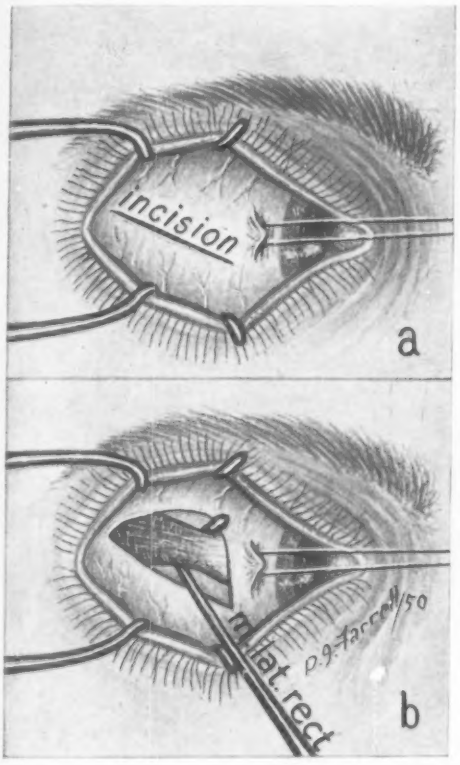


FIG. II. (a) Traction suture in the globe. Incision shown in the conjunctiva.
(b) Conjunctiva reflected displaying the lateral rectus muscle.

DISCUSSION.

The marked advantage of operating at the insertion is that the action of the inferior oblique muscle can be modified as the diagnosis requires, while in a tenotomy or myectomy at the origin no procedure so far devised has been satisfactory in limiting the effect with any degree of accuracy.

In the discussion following upon Watson White's presentation of a paper on this subject, Dunnington and Hughes commend the operation, but Hughes concludes with this statement: "What appears to be bilateral hyperphoria previous to an operation later proves to be only unilateral hyperphoria. This shows that myectomies do give good results." He states firstly that the girl in the case described appeared to have bilateral paralysis of the superior rectus muscle previous to her operation, but only a unilateral condition when the effect of the operation was apparent.

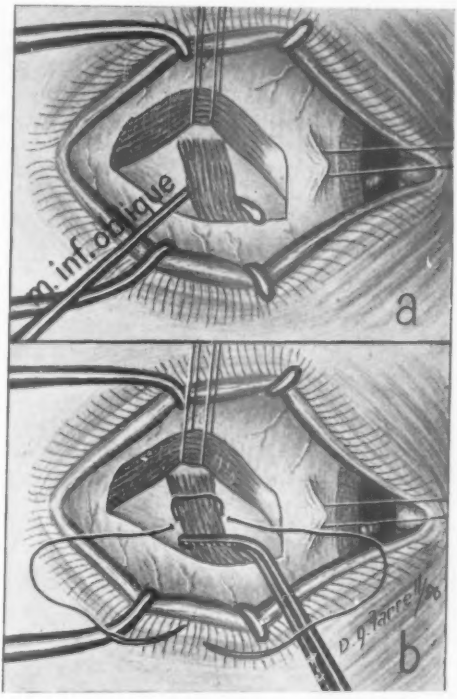


FIG. III. (a) The lateral rectus lifted to show the insertion of the inferior oblique.
(b) The inferior oblique is clamped and double atraumatic suture inserted into sclera.

This is a point on which I join issue with the accepted teaching that in these cases there is paralysis or paresis of the superior rectus. In numerous cases that I and my colleagues have examined we could find no evidence of superior rectus paresis, but there was marked overaction of the inferior oblique. I will discuss this a little later.

Berens in his discussion states that it is early to give accurate figures on the amount of recession required, but 20 prism diopters of vertical imbalance in the field of the inferior oblique muscles requires approximately 8 mm. of recession.

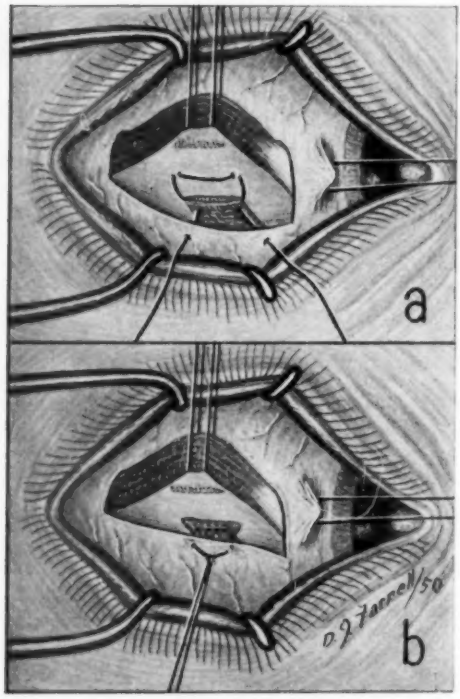


FIG. IV. (a) The inferior oblique removed from its insertion. Atraumatic suture passes through the inferior oblique and conjunctiva.

(b) The suture is tied off anchoring the inferior oblique at its new level of insertion. The expansion of the muscle is shown.

I think it is very difficult to measure the amount of upshoot or overaction of an inferior oblique, but one judges as one does in other squint operations, how much should be done, and it is advisable to do one muscle at a time and wait for a week or two to see what has happened, as I think the position of the eyes in squints is to a large extent under central nervous control associated with the degree of stimulation and effort made from the fusion centres.

White (1942), after a discussion on the underaction of the superior rectus which may vary from a paresis to a complete paralysis, goes on to say: "In order to correct a vertical imbalance by surgical procedure the questions involved are:

1. Whether to shorten by some means the paretic superior rectus, or to weaken the inferior oblique of the other eye.

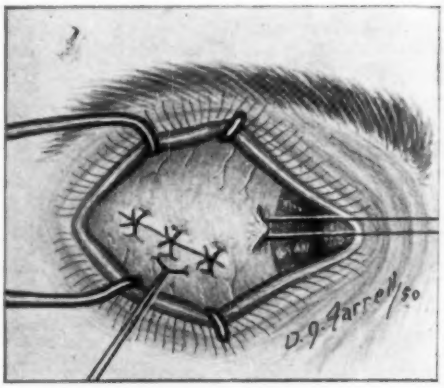


FIG. V. The operation completed. Conjunctiva approximated by interrupted sutures.

2. Whether in bilateral paresis of equal severity to shorten both superior recti or to lessen the action of both inferior oblique muscles.

3. When the paresis of the superior recti are unequal and the secondary deviations of the inferior obliques are likewise unequal, the question is: How can the desired results best be obtained?"

A B

FIG. VI. R.C. aged 10.

(a) Before operation.

(b) 3 months after recession of the left inferior oblique.

Notice ocular torticalles before operation and its absence afterwards.

No partial tenotomy at the origin can be graduated accurately enough to be dependable. With a unilateral hyperphoria or hypertropia over 15 prism diopters, increasing definitely in the field of the paretic superior rectus, a tenotomy or myomectomy at the origin is still very satisfactory, but when there is less than 15 prism diopters, or in bilateral superior rectus paralysis, the results are not uniform and not infrequently over corrections result.

In all bilateral cases now, where surgery of the inferior oblique muscle is indicated, the inferior obliques are receded in either equal or unequal amounts. We cannot advise just how much to recede for given amounts of correction. This corresponds to the experience in the recession of other muscles. The results have been so much more accurately judged and permanent when receding the inferior obliques, rather than performing a tenotomy or myomectomy as we formerly did, that I feel that in this procedure we have a much more definite and accurate means of control. When there is an associated convergent or divergent strabismus, the external recti may be prepared for a resection or recession, but before completing the operation the inferior oblique can be more easily engaged and receded. This combined operation through the one incision is proving more and more satisfactory.

Not infrequently, when the lateral deviation is high in amount, i.e., over 60° of esotropia or exotropia and the vertical deviation is not excessive, it is advisable to correct a part of the lateral deviation first. In this way the vertical deviation can be much more accurately estimated before deciding on how much the obliques should be receded.

Guibor (1943), discussing the operation, advises temporary removal of the external rectus from its insertion while recessing the inferior oblique. He says it makes the operation easier. Dunnington also makes this remark in the discussion on White's paper. I have found that this is not a necessary procedure and my partners and assistants have not found it necessary to remove the external rectus. To recess the inferior oblique, exposure of the insertion is quite adequate by pulling the external rectus upwards by one or two sling sutures.

Fink (1947) in his article on the anatomy of the obliques states:

A. Data obtained indicate that the anatomical variations are more numerous in the insertion of the superior oblique than any other rectus muscle. Variations in the insertion of the inferior oblique are next in frequency.

B. Because of the wide variations in the position of the insertion of these muscles, the study suggests the possibility that a so-called "paretic" muscle may be abnormal in action because of an unusual insertion. It seems likely that many of the obscure actions of these muscles may be explained by variation in insertions to the eyeball.

C. In considering the superior oblique muscle the work indicates that a favourable and feasible surgical approach could be made at its insertion.

D. In the case of the inferior oblique the study suggests the possibilities of a more satisfactory surgical management. Surgery can and should be done on the insertion rather than the origin. This is due to the easier approach and the nature of the anatomy.

E. The study also serves to show the possible intimate relation of the inferior oblique to the optic nerve and other important structures. This should be kept in mind in operations upon the muscle.

The global insertion of the inferior oblique is about 11 mm. posterior to the insertion of the external rectus. "One cannot adequately re-attach a muscle to the globe with a single central suture and expect that attachment to have a spread of approximately 10 mm. This narrow point of insertion could conceivably have a marked effect on the efficiency of these same muscles when they are used in the oblique or vertical positions of gaze." (Fralick discussing Fink's paper.)

Costenbader, discussing squint, makes these comments at the end of his article:

"Certain miscellaneous observations are worthy of comment. We have constantly noted that an amblyopic eye would seem to have poor abducting power and we earlier assumed that the lateral rectus muscle was paretic. More recently having cured much of the amblyopia, we have noted that abduction becomes normal as visual acuity improves."

Further we have frequently noted that a squinter with an amblyopic eye has primary and secondary deviation. In other words, when the "good" eye is fixing, the deviation is less, but when the amblyopic eye is fixing, the deviation is greater. We have assumed that more accommodative effort is exerted when the amblyopic eye is fixing and that this causes a greater convergence. These two points illustrate ways in which vision affects the function of muscles.

In the last case of recession of the inferior oblique and recession of the opposite medial rectus done by Dr. K. B. Redmond by our usual technique, with an upshoot of about 30° before operation, the result a month later is very pleasing. By careful examination before operation neither he nor I could elicit any suggestion of paresis of either superior recti. I am of the opinion that the explanation of these overactions of the inferior obliques is to be explained largely by the anatomical variations stated by Fink and by the visual effects on the muscles when there is an inherited deficiency of fusion sense.

ACKNOWLEDGEMENT.

Examinations and operations have been carried out on similar types of cases by my partners, Drs. A. E. Colvin, R. S. Candlish, T. C. Meurer and K. B. Redmond, and by several of our assistants. Operation on the insertion of the inferior oblique has been our standard practice since 1935, and I would commend it to you as worthy of your consideration. My thanks are also due to Dr. Gordon Bruce, of New York Presbyterian Eye Hospital, for sending me copies of the papers by James Watson White and Walter H. Fink.

SUMMARY.

1. A method of operating on the inferior oblique at its insertion to the globe is described —
   (a) by tenotomy;
   (b) by recession.
2. A discussion on some of the literature is given.
3. A suggestion as to the cause of overaction is given.
4. Case reports are detailed.

REFERENCES.

BING, R. (1940), "Compendium of regional diagnosis in lesions of brain and spinal cord." St. Louis: C. V. Morley & Co.

COSTENBADER, F., BLAIR, D and MCPHAIL, A., (1948), *Arch. Ophth.*, vol. 40.

FINK, W. H. (1947), *Trans. Amer. Acad. Ophth.*, vol. 51, page 500.

GUIBOR, G. P. (1943), *Amer. J. Ophth.*, vol. 26, page 833.

KIRBY, D. (1946), *Amer. J. Ophth.*, vol. 29, page 408.

KREWSON, W. E. (1944), *Arch. Ophth.*, vol. 32, page 204.

SPAETH, E. B. (1944), "Principles and practice of ophthalmic surgery." Philadelphia: Lea & Febiger.

VOLKMANN, A. W. (1869), *Verh. Sächs. Ges. Wiss.*, vol. 21, page 23.

WHITE, J. W. (1942), *Trans. Amer. Ophth. Soc.*, Seventy-eighth Annual Meeting.

WHITNALL, E. S. (1932), "Anatomy of the human orbit." Oxford University Press.

THE TREATMENT OF CARCINOMA OF THE BREAST.

By Victor M. Coppleson.
Sydney.

THE attitude towards the management of carcinoma of the breast is undergoing radical changes. Opinions which have been firmly held for half a century are being challenged. There can now be little doubt that the significance previously ascribed to nipple discharges in relation to malignancy has been greatly exaggerated. Bleeding nipples can no longer be regarded as having any special diagnostic or prognostic value and the well-established view that duct papilloma is pre-malignant has been shown to be false (Adair, 1949, b).

Much the same can be said of chronic cystic disease or cystic mastitis. On the grounds that it is pre-malignant, it has been the cause of much unnecessary surgery. Observations of large numbers of these patients by Adair (1949, b), has not supported the presumption that this condition is pre-malignant. It appears to be not far removed from normal and the cysts disappear at the menopause and do not return. He observed 400 cases for some years and operated on only 3 of them for carcinoma.

Another development of considerable interest, but of doubtful application to the human subject has been the discovery of the Bittner milk factor in experimental mice. It has been shown in these mice that mothers having this factor themselves usually at some stage of their lives develop cancer of the breast, and that the factor is transmitted to their female children through their milk.

Although there is strong evidence of an hereditary factor in humans, efforts to prove the existence of a similar milk factor have so far failed. If it were true for humans, it would mean that women whose mothers or grandmothers have developed cancer of the breast and who have been suckled by them should not at any time nurse their own female children.

A modern addition must also be made to the differential diagnosis of carcinoma of the breast. In women taking large doses of oestrogens or using oestrogenic face creams or lotions, hard localized areas of mastitis, which closely simulate carcinoma, may develop.

Classification of Carcinoma of the Breast.

The problem of carcinoma of the breast has now largely resolved itself into one of biometrics. Many papers on carcinoma of the breast are appearing, quoting tables of statistics and many giving different classifications. The classification used in this paper is based on a widely used Steinthal method, of which the following is a simple modification:

Stage I	Tumour limited to the breast.
Stage II	Tumour of the breast and axillary glands.
Stage III	Disease advanced with local metastases.
Stage IV	Disease advanced with distant metastases.

Surgery.

No other method has offered such good results in the treatment of cancer of the breast as surgery. Alone it offers from a 60 to 80 per cent chance of a five years' cure in Stage I, but only 20 to 30 per cent in Stage II. The mortality of the operation in this country is very low. In most details of the operation there is agreement. There are major differences of view concerning the extent of skin removal, the extent of removal of glands particularly the axillary, and the supra-clavicular glands. There are minor differences concerning the extent of removal of the pectoralis major muscle and other details.

Removal of skin.

In the Halstead method, which was the foundation of the modern operation, all tissues, including skin and muscles, were removed equally to the chest wall over a wide area. This left large bare areas of the chest wall, which often required skin

grafting. This operation, almost unchanged, is still practised widely in the United States. Those who use it appear to have a much higher operative mortality rate than more conservative surgeons.

Whilst a wide area of skin, with the tumour as its centre, must undoubtedly be removed, a needless sacrifice of skin appears to be made in the unmodified Halstead technique.

The work of Sampson Handley has shown that such wide removal of skin is not necessary and many publications both in Great Britain and the United States have supported the soundness of his views. Skin grafting is occasionally necessary, but it is surprising what large areas of chest wall can be covered by a large anterior Estlander flap fashioned at the lower end of the wound. Mention may here be made of a method which is probably peculiar to Sydney and which was often practised by Sir Alexander MacCormick. This consists in making in tight flaps what he called "weep-holes" — holes through the full thickness of the flap usually near its centre about one to two inches long, parallel to the edge of the flap at some distance from it. They are made at the points of most tension after the wound is sewn up in order to lessen tension and to provide drainage.

Removal of glands.

In regard to the removal of glands, all surgeons are interested in the work which has been in progress at the Edinburgh Royal Infirmary since 1941. The method which is being employed there consists of simple mastectomy of the cancerous breast with post-operative irradiation of the undissected axilla. McWhirter (1948) recently claimed that the method gave results which were superior to those of the radical operation. Riddell (1948) and others have criticised the method on the grounds of persistence of actively malignant cells in the axilla in scar tissue after the termination of treatment and contend that radical surgery is more certain and more thorough than X-rays in the treatment of the axilla.

In regard to the supra-clavicular glands, the surgeon's management varies with his view of their anatomy. Wakeley (1948) considers that there is no connection between the axillary and supra-clavicular glands except through the glands of the upper intercostal spaces or internal mammary glands. The more usual view is that these glands communicate with the apical glands of the axilla and that some of the lymph from the axilla may go through these glands to the jugular trunk; but the efferents from the apical glands of the axilla go mainly to form the subclavian lymph trunk. Whilst sometimes these glands may be secondarily infected from the axillary glands, it is probable that they are not infrequently infected direct from growths in the upper half of the breast by lymph trunks passing in front of the clavicle. Involvement of these glands must not necessarily be regarded as a sign of inoperability. Their removal is not indicated routinely as part of the radical operation, but if they are not fixed, they should be widely excised at the first sign of involvement either at operation or if they are discovered later.

Removal of Pectoralis Major.

In regard to the extent of removal of the pectoralis major, many surgeons leave the clavicular part of the muscle. The advocates of total removal of the muscle in all cases, claim that total removal is necessary for proper and thorough treatment of the axilla. There is little or no evidence to show that saving the clavicular head of the pectoralis major increases recurrences; on the other hand, it is claimed (Wakeley, 1948) that oedema of the arm is more common after total removal of the muscle, and adhesion of the skin to the underlying vessels may occur with distressing results.

The question has been raised whether we are sufficiently radical in our operation. Whilst it is suggested that the most meticulous and radical surgery is necessary, and that all recurrences wherever possible in the skin, supra-clavicular glands or wherever reasonably removable should be eradicated, there can be little sympathy with the advocates of interscapulo-thoracic amputation, removal or division of the clavicle or routine removal of the axillary vein for carcinoma of the breast. These are too great a price to pay for the little, if any, gain.

ANCILLARY METHODS.

Three methods ancillary to surgery, castration, radiation and hormone therapy, are in common use.

Castration.

For over fifty years, castration has been advocated in the treatment of carcinoma of the breast, but has not yet been generally accepted. It is probable (Thayssen, 1948) that it may result in some additional years of life in relative comfort to the patient, and it may also prolong life to some extent. It is being used by many surgeons who claim good results, but it cannot be regarded as a guarantee against the development of secondaries.

Castration may be effected by operation, by X-rays or by radium, or it may be accomplished physiologically by the androgens. It has been claimed by Horsley (1947) that castration by operation is the more effective. He advises that in pre-menopausal patients, bilateral oophorectomy should be done at the same time as the radical mastectomy. It has been found (Halberstater, 1946) that castration does not completely stop oestrogen activity and that after a time it reappears to some extent.

Patients who are still menstruating and who are near the menopause should, without doubt, be subjected to castration by some method. In younger women, until more evidence of its value is available, it is questionable whether the serious changes induced by castration are justified by its doubtful benefits.

Radiation.

The work of Keynes in the use of radium in carcinoma of the breast, although now discarded in favour of deep therapy, has been a milestone in the treatment by radiation. His method of simple mastectomy and irradiation of the untreated axilla is in many ways similar to the Edinburgh method.

Radiation is limited by skin tolerance. This determines the dosage rather than the cancericidal dose. The enthusiasm for deep radiation varies from one extreme to the other — from those who advocate it in preference to all other methods to those who never use it. Most surgeons appear to be more or less in agreement on a number of points.

1. Treatment of tumours, Stage I or Stage II, in operable patients by radiation alone is unjustifiable by any known results (Adair, 1949).

2. Pre-operative irradiation: Adair (1949) claims that the results have been better without pre-operative irradiation than with it. There is the uncertainty of diagnosis, the irksome and harmful delay of from six to ten weeks and often refusal of operation by the patient, the increased difficulty of operation and liability of the skin flaps to slough. No amount of pre-operative irradiation will convert an inoperable into an operable growth. Pre-operative irradiation has largely been discarded.

3. Post-operative irradiation: The opinions of surgeons vary. The statistics appear to show that there is a definite improvement in results in Stage II and most surgeons use it as a routine for this group. Many surgeons do not employ it in Stage I. Riddell (1948) and many others, however, employ it routinely in all patients post-operatively.

4. Irradiation is to be preferred to surgery in Stage III.

Hormone therapy.

There is considerable experimental and other evidence to show that both oestrogens and androgens influence the course of mammary carcinoma. Although ideas have not yet been crystallized, many facts of interest are emerging. The general view at present appears to be that, suitably employed, hormones have a beneficial effect possibly inhibitory, but not curative.

The beneficial effects of androgen therapy include gain in weight and strength with a sense of well being, decrease of pain and evidence of calcification of bony metastases. Testosterone appears to have a general effect on metabolic processes rather than any specific effect on the tumour cells. The improvement in the patient's general condition may be most striking. It is upon metastases in bone that the effect of androgens is particularly noticeable; the entire osseous system becomes more dense and

local areas of destruction often fill in with bone salts. Reports of relief up to two years have been published (Adair, 1949, a). The treatment is expensive. The dose used is 100 mg. three times a week intramuscularly for ten weeks, after which a maintenance dose of 40 to 60 mg. daily of methyl testosterone is given for eight weeks. It is the hormone of choice in young women. It is contra-indicated in patients with high blood calcium levels. Adair routinely implants 300 mg. of testosterone in the latissimus dorsi muscle at all operations for radical mastectomy. Claims have been made that its use post-operatively as a prophylactic has considerably reduced the incidence of secondary growths.

The oestrogens have been used particularly in older women. They should not be used in women who are still menstruating or who have reached the menopause only a few years previously. It was first described in England by Haddow and others in 1944. It was shown to have some effect on metastases in soft tissues and further reports have supported this. Doses of stilboestrol 15 mg. daily are usually given, but some surgeons use up to 200 mg. daily. Ethinyl estradiol 1 mg. three times daily, oestrone sulphate 10 mg. three times daily and oestradiol benzoate 3.32 mg. intramuscularly three times weekly have also been used.

The value of hormone therapy is at present undetermined. Properly used, it shows beneficial effects in a number of cases, but any curative effect has yet to be demonstrated.

REFERENCES.

ADAIR, F. E. (1949) (a), *Proc. Roy. Soc. Med.*, vol. 42, page 468.

—— (1949) (b), *Ann. Roy. Coll. Surg., England* vol. 4, page 360.

ADAIR, F. E., ESCHER, G. C., FARROW, J. H., MELLORS, R. C., URBAN, J. A., and WOODARD, H. Q. (1949), *J. Amer. Med. Assoc.*, vol. 140, page 1194.

HADDOW, A., PATERSON, E., and WATKINSON, J. M. (1944), *Brit. Med. J.*, vol. 2, page 393.

HALBERSTAEDTER, L., and HOCHMAN, A. (1945), *J. Amer. Med. Assoc.*, vol. 131, page 810.

HORSLEY, Guy W. (1947), *Ann. Surg.*, vol. 125, page 703.

McWHIRTER, R. (1948), *Proc. Roy. Soc. Med.*, vol. 41, page 122.

RIDDELL, V. H. (1948), *Ann. Roy. Coll. Surg., England*, vol. 3, page 15.

THAYSSEN, Viggo E. (1948), *Acta Radiol., Stockholm*, vol. 29, page 189.

WAKELEY, Sir Cecil (1948), *Brit. Med. J.*, vol. 2, page 631.

THE OPERATION FOR UNDESCENDED TESTES IN THE SUPERFICIAL INGUINAL POUCH.

By C. Craig.
Launceston.

Introduction.

THERE is no doubt that in the practice of surgery failure is a great stimulus to effort. In operating on undescended testes my failures have been inability to make the testis reach the scrotum, inability to keep it there and atrophy of the testis. It is the practice, in this hospital, if a surgeon is finding difficulties with a particular surgical problem, to place under his care, for a period, all those cases which have a bearing on that problem, so that he may make a concentrated study of it. This paper is the result of such a study.

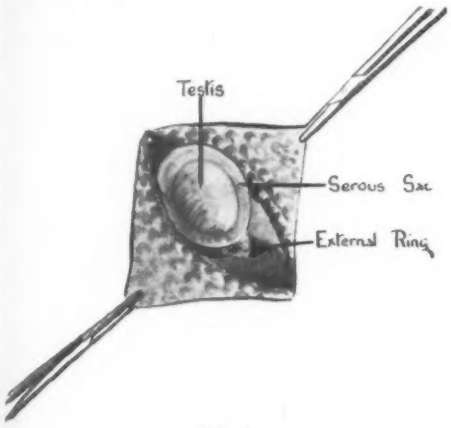


FIG. I

The study is restricted to that type of undescended testis which lies in the superficial inguinal pouch. This pouch, which should be called the "external inguinal pouch of Denis Browne" (1938) because he was the first to describe it accurately, lies outside the external inguinal ring. The testis, having emerged from the ring, has turned outwards towards the anterior superior spine and lies in the subcutaneous tissues within a short distance of the external ring. In my experience it is always, in this position, surrounded by a serous sac (Fig. I). Apart from "migratory" testes which are not undescended testes at all, this is the commonest form of undescended (or ectopic) testis. Probably over 90 per cent of all cases are of this type.

There would seem to be a great deal of difference of opinion as to the correct age for operation. Provided the surgeon has not decided to wait till puberty in order to see if descent occurs naturally, the operation may be undertaken when the surgeon judges from the boy's appearance that the vas will be sufficiently strong.

No reference will be made to the use of hormones, as sufficient evidence has not yet accumulated.

The Operation.

Step 1.

The incision commences over the internal ring and passes down over the external ring until it is felt that there will be sufficient access to the scrotum. As the testis is subcutaneous, the dissection must proceed slowly until the serous sac that surrounds the testis comes into view. It is usually recommended that this sac be opened, but it is better to leave it closed. It is quite easy to dissect out, and if left intact, forms a perfect vaginal sheath for the testis. If the surgeon wishes to study possible deformities of the testis, the sac should be opened and then closed. Occasionally it happens that the sac is the lower end of a hernial sac of the so-called "infantile" type. If this is the case, the lower end of the sac should be preserved so that it can be sewn over to make a vaginal sheath for the testis.

Step 2.

Whilst dissection of the serous sac is proceeding, it is possible to leave firmly attached to it a piece of subcutaneous tissue. A light pair of artery forceps may be placed on this piece of tissue and the handling of the testis thus made easier. An incision 1 cm. long is made in the external oblique aponeurosis over the canal, making certain that the

inguinal branch of the ilio-inguinal nerve is not damaged. Each edge is caught with artery forceps. A director is then passed down to the external ring so as to press away the cord from the ring and the whole roof of the canal is opened. The cord is now separated from the surrounding tissues up to the level of the internal ring. It will be found that this manoeuvre lengthens the cord so that the testis will just enter the top of the scrotum.

Step 3.

It is necessary to refrain from doing two things that are often advised. The first piece of advice that must be rejected is to divide everything except the vas and its artery. I have followed this advice on two occasions and on both occasions the testis has atrophied. This cannot be accepted as proof that atrophy of the testis will always follow such a procedure, but nevertheless I do not wish to put the matter to further proof, particularly as the procedure is unnecessary.

The next piece of advice to be rejected is that which urges that the cord should be opened, placed on the stretch, and that every piece of fibrous tissue within it should be divided. In following this advice I have on two occasions divided an artery and on both occasions the testis has atrophied. Again the procedure is unnecessary.

Step 4.

The hernial sac, if present, is separated from the cord.

It is usually stated that a hernial sac is always associated with an undescended testis, but this is not the case. It is true that very often definite sacs are found. These may be of two varieties — firstly, that of the "infantile" type where the sac passes right down to the testis, and secondly, the ordinary type where the sac lies in the cord but does not extend to the testis. If either of these varieties of sac is found, it must be separated in the usual way and removed. The separation of "infantile" sacs may be very difficult and a special technique is needed. As this matter belongs to the surgery of hernia rather than to that of undescended testis, a description of this technique will not be given here. If neither of these types of sac is present, slight tension is placed on the cord and a search is made on the anterior surface of the cord within 2 cm. of its origin. With experience it is possible to see, enclosed in the cord, a small pouch of peritoneum shaped like a half-moon and not quite as long as the tip of the patient's little finger. (Fig. II). It might be thought that this was a rudimentary sac. On several occasions, however, I have opened the peritoneum above the internal ring, and by looking from the inside have made certain that the process of peritoneum did not enter the cord unless slight tension was exerted on it. There is no doubt, however, that the peritoneum here is in intimate relationship with the origin of the cord. With very delicate dissection the "process" of peritoneum is separated from the cord and then twisted and ligated. The separation of the constituents of the cord and of the perioneum should continue within the pelvis in all cases until the external iliac artery can be felt beating.

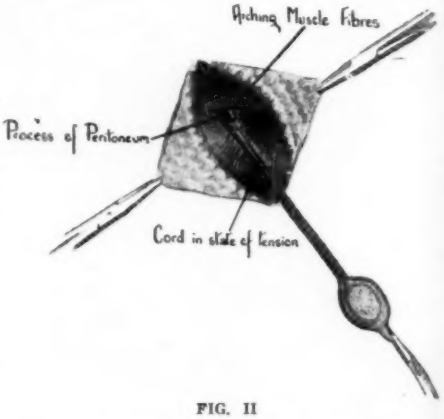


FIG. II

When dealing with a boy under the age of puberty, it is unnecessary to do anything more about the hernia than to remove the sac. The advice, very often given, that an extensive plastic procedure involving the whole canal should be carried out, must be disregarded. Such a procedure is not only unnecessary, but may be actually harmful.

When the sac has been dealt with, it will be found in the majority of cases that the cord is sufficiently long to allow the testis to be placed in the scrotum without tension. In a few cases, however, there is still not sufficient length and further dissection is necessary.

It is essential for this further dissection that a headlamp be worn. Long, thin-bladed retractors are inserted in the region of the internal ring. The two main constituents of the cord, the vas and the testicular vessels, are now separated from their surrounding tissues as far up as possible. When the testicular vessels are being delivered from the pelvis, it is found that there comes with them on the lateral side a long piece of areolar tissue which contains a few globules of fat. When this piece of tissue is divided where it is marked with an arrow in Fig. III it is found that the leash of vessels is released by a further length of about 2.5 cm.

On two occasions I have found that I did not have enough room to carry out this process of separation of the vas and vessels. On these occasions I cut laterally into the fleshy origin of the conjoined muscle for a distance of 2.5 cm., re-sewing the divided muscle later.

So far I have found that this process of separation is always successful and gives the cord plenty of length.

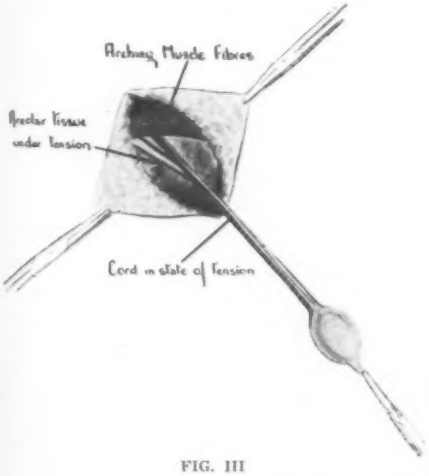


FIG. III

Attention is drawn to the possibility at this stage of having to divide the inguinal branch of the ilio-inguinal nerve in order that the cord may be lengthened. The anatomy of this nerve varies. At times all that has to be done is to avoid it. At other times it is found, when the testis and its sac have been dissected free, that the ends of the nerve are embedded in the sac in which event it is impossible to get the testis to the bottom of the scrotum. Two courses of action are open. One is to remove the testis from the sac, leaving the nerve behind. The other — and it must be remembered that the nerve is a sensory one — is to section it high up just before it crosses the inguinal canal. The latter procedure is being followed at present.

Step 5.

A pair of tissue forceps is placed on each side of the lower part of the incision. They are raised and separated and a tunnel is made into the scrotum by introducing dissecting scissors and then opening them.

Step 6.

Vermooten's (1947) procedure is carried out by passing a pair of forceps from below in such a way as to invert the scrotum into the wound. Using a fine knife, the forceps are cut down upon so that all tissues except the skin are divided. Vermooten claims that this procedure divides the elastic tissue of the scrotum so that the scrotum cannot eject the testis.

Step 7.

A long piece of silk is taken, each end of which is threaded to a long, straight, skin-cutting needle. The silk is passed through the piece of subcutaneous tissue left attached to the sac or through the sac itself. The sharp end of one needle is then enclosed in an artery forceps, passed to the bottom of the scrotum, and pushed through. The same is done with the other needle. The sac containing the testis is drawn down into the scrotum. The silk is tied on the outside of the scrotum, the ends being left long.

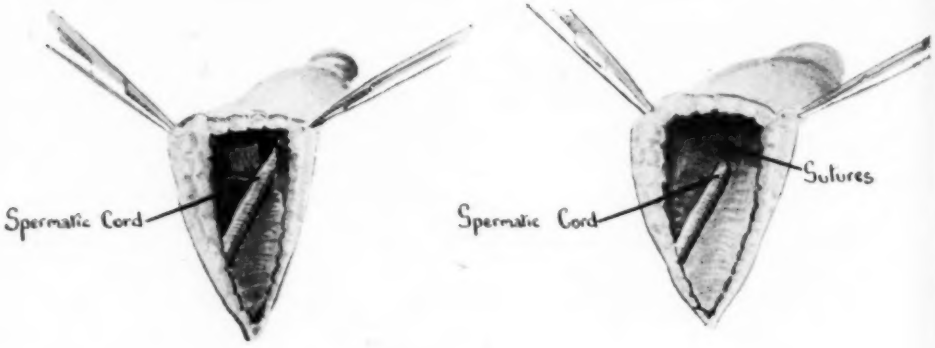
Step 8.

This step was recently described by Wershub (1948) adapting McGregor's (1929) work, and as far as keeping the testis in the scrotum is concerned, it is the key step. The two forceps previously placed on each side of the wound are drawn apart in such a way that the interior of the scrotum is visible. It will then be seen that running up on each side of the cord are two bands of tissue which were originally formed when the dissecting scissors were thrust into the scrotum (Fig. IVa). Using fine silk, interrupted sutures are placed so as to draw

these bands of tissue together (Fig. IVb). If this is done properly, the testis cannot escape from the scrotum.

Step 9.

I think Torek's procedure is quite unnecessary, particularly if Step 8 has been properly carried out. Elastic bands to the thigh should be equally unnecessary and have the disadvantage that stretching of the vessels may cause thrombosis with consequent atrophy of the testis. At present I am sewing one of the long ends of silk brought through the scrotum to the thigh and tying it to the other.



A FIG. IV B

Step 10.

The incision is closed in the usual way.

After-treatment.

The only point worth mentioning in regard to after-treatment is that the patient is put on suitable doses of a suitable sulphonamide for forty-eight hours.

RESULTS.

Excluding cases done within the last six months, I have operated on ten patients with ectopic testes in the superficial inguinal pouch by the method described. Each of these has been followed up personally, and in each case the testis has been found lying in its normal position and to be of normal size. All patients were under the age of puberty.

SUMMARY.

In describing the operation for ectopic testes lying in the superficial inguinal pouch, special attention has been drawn to the following points:

1. The serous sac that surrounds the testis should be preserved as a vaginal sheath.
2. The anatomy of the cord need not be disturbed except to dissect out the hernial sac or attached peritoneum.
3. The statement that a hernial sac is always present is denied and the relationship of the peritoneum to the internal ring in the absence of a sac is described. All that is necessary to cure the hernia is removal of the sac. Plastic procedures are unnecessary.
4. The method of separating the testicular vessels and the vas far into the pelvis is described.
5. The method of keeping the testis in the scrotum without performing Torek's manoeuvre is described.
6. The results in 10 cases are given.

ACKNOWLEDGEMENTS.

I wish to acknowledge the enthusiastic co-operation of Dr. C. L. Park, Director of Public Health, Dr. K. Welch and Dr. H. Spencer Roberts, Government Medical Officers.

REFERENCES.

BROWNE, D. (1938), *Brit. Med. J.*, vol. 2, page 168.
McGREGOR, A. L. (1929), *Surg. Gynec. Obstet.*, vol. 49, page 273.
VERMOOTEN, V. (1947), *J. Urol.*, vol. 57, page 310.
WERSHUB, L. P. (1948), *J. Urol.*, vol. 60, page 631.

FOUR UNUSUAL COMPLICATIONS OF PARTIAL GASTRECTOMY.

By J. P. Fleming and J. N. Ward-McQuaid.
(From the Division of Surgery, Radcliffe Infirmary, Oxford.)

PARTIAL gastrectomy for peptic ulcer is one of the most satisfactory operations in surgery. Of the few failures most are due either to recurrent ulceration or to the "dumping" syndrome. Technical errors are responsible for occasional failures such as early obstruction of the afferent jejunal loop. Late obstruction from adhesions following a well-performed operation generally occurs in the efferent loop and rarely in the afferent loop. An example of failure from a gross technical error is the anastomosis of the stomach remnant to the wrong viscus following a partial gastrectomy.

Four unusual complications of Polya partial gastrectomies are now described. The proximal loop was anastomosed to the lesser curve in front of the colon in each case.

Case Reports.

Case 1. R.I. No. 74417. Perforation of an afferent loop jejunal ulcer following partial gastrectomy.

A post office clerk had suffered from symptoms of peptic ulcer since the age of 30, and was discharged from the Royal Air Force on that account. He had been suspected of having a leaking ulcer and had had two haematemeses. A fractional test-meal showed an acid curve within normal limits. In October, 1947, when he was 35 years of age, a "three-quarter" gastrectomy was performed, without division of the short gastric vessels, for duodenal and pre-pyloric ulcers.

He lost 14 pounds in weight following the operation and suffered from a mild iron-deficiency anaemia. The functional result was satisfactory until August, 1948, when he developed pain in the back which radiated around the abdomen and was associated with vomiting and constipation. On admission to the Radcliffe Infirmary five days later, he was in pain and guarding of the epigastrium was present. A few hours later he was seized with violent abdominal pain and had clearly suffered a perforation. At operation (J.P.F.) there was a general peritonitis due to a perforation, 2.5 cm. in diameter, of the jejunal loop 7.5 cm. proximal to the anastomosis. An acute jejunal ulcer had perforated and formed a local abscess, which had subsequently ruptured, causing general peritonitis. The perforation was closed with difficulty. A Miller-Abbott tube was introduced into the small intestine before the abdomen was closed. The patient recovered.

He then returned to a dietetic régime, and in December, 1948, he was readmitted for assessment. X-ray examination after a barium meal was normal and no occult blood was found in the faeces; a fractional test-meal showed no free acid. In view of these findings, a vagotomy was not performed.

In June, 1949, the patient had an iron deficiency anaemia and was suffering from epigastric fullness after meals. He had been on a normal diet for three months with no apparent ill-effects. He was admitted for gastroscopy and a repetition of the tests previously performed. The results were satisfactory, and no further operative treatment was advised.

Discussion.

The incidence of jejunal ulceration following partial gastrectomy is variously given as ½ - 10 per cent. Many of these ulcers follow one of the less radical partial gastrectomies performed for duodenal ulcers in young men, especially when there is a high, sustained acid curve in a fractional test-meal. In reported series of jejunal ulcers, between 5 and 23 per cent have perforated, and Warren and Fallis (1944) consider that rather more than 200 perforated jejunal ulcers have been recorded. Elsewhere (1946) they state that the afferent loop is singularly immune from ulceration. Toland and Thompson (1936), in their review of 120 perforations of jejunal ulcers, found only 10 in the afferent loop. These afferent loop perforations all followed gastro-enterostomy, emphasising the extreme rarity of a perforation of an afferent loop jejunal ulcer after partial gastrectomy.

Many of the patients with a perforating jejunal ulcer have had a previous gastro-duodenal perforation, and some of them suffer from recurrent jejunal perforation. Marshall and Devine (1941) consider that, although gastro-jejunal ulcers are extraordinarily resistant to ordinary medical régimes, many will respond to more strict medical treatment.

This patient was a relatively young man in whom jejunal ulceration followed a "three-quarter" partial gastrectomy performed for duedonal ulceration. The acid curve was normal, but perforation of the ulcer had been suspected two years before operation. Although the patient had a mild iron-deficiency anaemia and had lost some weight, there were no other features to suggest jejunal ulceration until five days before perforation.

Following suture of the perforation, there was no further evidence of ulceration. The absence of free acid in two test-meals, however, is not necessarily significant after a partial gastrectomy, even when the tip of the tube is seen by radiography to lie in the stomach.

The cure of this patient's jejunal ulcer is not necessarily real or permanent. An alteration in the mechanics of the stoma following suture of the ulcer is a possible explanation for the fact that there has so far been no sign of recurrence of the ulcer. Further operative intervention does not seem justified at the present time.

Case 2. R.I. No. 6572/43. Partial gastrectomy followed by "dumping" syndrome and acute intestinal obstruction from orange pith in the jejunum.

A college servant, aged 45, had a high Polya partial gastrectomy performed in April, 1947, for a prepyloric ulcer which had been present for twenty years. He gained 14 pounds in weight, but suffered from mild "dumping" symptoms. These took the usual form of fullness in the epigastrium soon after meals, and dizziness and sweating an hour or so later. These symptoms were worse after copious fluids and were relieved by lying back. Ephedrine was without effect, but symptoms could be almost completely relieved by restricting fluids and taking olive oil before meals. In a glucose tolerance test (Fig. I) the blood-sugar rose rapidly to 238 mg. per cent half an hour after the meal, falling to 67 mg. per cent an hour later, and soon after this his typical symptoms commenced.

In June, 1948, in the afternoon, he ate a large Jaffa orange and swallowed much of the tough pith. His supper provoked colicky central abdominal pain and he vomited a few hours later. On admission to the Radcliffe Infirmary the next afternoon, he was clearly suffering from acute obstruction of the small bowel. At operation, by Mr. A. Elliot-Smith, the efferent loop of the jejunum as it left the stomach was seen to be dilated to some 7.5 cm. in diameter. The obstruction was found to be due to a mass of orange pith about 5 x 7.5 cm., which was impacted in the lower jejunum. The orange pith was removed through an incision in the anti-mesenteric border of the bowel. The patient recovered.

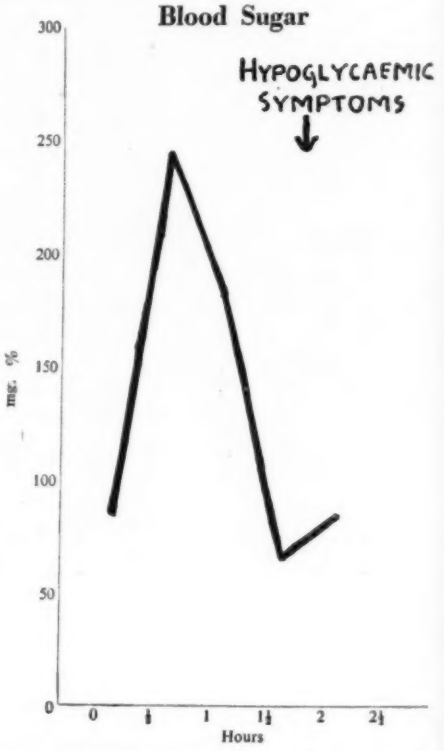


FIG. I. Glucose tolerance test in Case 2, showing the onset of hypoglycaemic symptoms, and the rapid rise and fall in blood sugar after 50 gm. of glucose by mouth.

DISCUSSION.

The impaction of various foodstuffs in the intestine is one of the least common causes of acute intestinal obstruction. Elliott (1932) reviewed 39 cases, including one due to a bolus of orange pith. He quotes Seifert (1930) as operating on a woman with acute intestinal obstruction due to sauerkraut impacted in the ileum five years after a Billroth II partial gastrectomy for ulcer. Baumeister and Darling (1947) describe a case very similar to the one now reported, in which acute small bowel obstruction followed impaction of a bolus of orange pith in the ileum of a man with "dumping" symptoms after a partial gastrectomy for ulcer. Allen and Smithwick (1942) discuss the impaction of orange pith in the ileum

of a man on whom a partial gastrectomy for peptic ulceration had been performed twelve years previously. Delrio et al. (1944) describe a case of intestinal obstruction due to orange pith following gastro-enterostomy for ulcer.

The post-prandial symptoms in the present case were both of early and of late onset, as described by Aldersberg and Hammersclag (1947). The sensation of fullness soon after the meal is generally attributed to rapid emptying of the stomach with distension of the jejunum and the later symptoms of dizziness and sweating to chemical factors, especially hypoglycaemia. Irvine (1948), however, considers that post-prandial symptoms following partial gastrectomy are not likely to be due to hypoglycaemia. All his cases had early symptoms and these occurred in the hyperglycaemic stage. He did not investigate patients with symptoms of late onset.

In the present case the orange bolus had passed readily through the wide stoma and dilated upper jejunum and impacted in the narrow lower jejunum. In most cases of food obstruction, impaction occurs in the lower ileum where the intestinal lumen is smaller and its contents more solid than in the jejunum.

Case 3. R.I. No. 30290. Obstruction of the afferent loop following partial gastrectomy.

A clerk, aged 69 years, had had a partial gastrectomy of the Polya type with a Hofmeister valve performed in 1945 for a gastric ulcer which had perforated in 1944.

In April, 1949, he was admitted to the Radcliffe Infirmary complaining of abdominal discomfort and flatulence, which had been present for three hours, and had been followed by colicky pain and vomiting. On examination his pulse rate was 60 per minute and his temperature normal. He lay with his knees drawn up; he was pale and somewhat shocked, and emitted frequent eructations. There was a round swelling in the epigastrium and left hypochondrium. It moved on respiration, was dull on percussion and its margins were indefinite.

After aspiration of the stomach and the administration of intravenous fluid his general condition improved and his symptoms subsided.

X-ray examination after a barium meal some days later showed no particular abnormality, but no comment was made by the radiologist as to whether or not barium entered the afferent loop. X-ray examination after a barium enema, however, revealed a large mass displacing the transverse colon upwards and forwards, but lying outside the large bowel (Fig. II). The radiologist suggested that this mass might be a collection of fluid in the position formerly occupied by the lesser sac. There was a suggestion of serration about the margin of the mass which resembled the appearance of mucous membrane of the small bowel. The leucocyte count was normal.

FIG. II. Barium enema radiograph in Case 3, showing upward displacement of transverse colon by distended afferent jejunal loop.

A week after admission the patient became jaundiced; the serum bilirubin was 2.5 mg. per 100 ml. The jaundice subsided a week later.

At operation by Mr. D. C. Corry, two weeks after admission to hospital, a hypertrophied afferent loop was found, dilated to about 12 cm. in diameter. There were numerous adhesions between the upper border of the body of the pancreas, the remains of the lesser omentum and the afferent loop of the jejunum. These adhesions converged on the jejunum at the upper end of the anastomotic line and here the bowel was somewhat stenosed. The adhesions were freed and a plastic operation was performed on the stenosed section of the bowel. Convalescence was uneventful.

Three months later, when seen in the follow-up clinic, this patient was well, free from symptoms and was gaining weight.

DISCUSSION.

Obstruction of the jejunum following a badly executed gastro-enterostomy can well be understood. Obstruction of the efferent loop by adhesions, even in a correctly per-

formed operation, is a well-recognised late complication, but late obstruction of the afferent loop is uncommon. There is little reference to this condition in the literature. Wilkie (1934) described the condition of afferent loop ileus associated with gastro-enterostomy. Jaundice was not included in his description which differs from the condition now described.

The possibility of afferent loop obstruction should be brought to mind when partial gastrectomy is followed by a palpable tumour in the epigastrium and transient jaundice.

One does not often see any comment by the radiologist as to whether or not the afferent loop fills in a barium meal performed after partial gastrectomy. Positive evidence of filling on barium meal radiography would help to exclude obstruction of the afferent loop.

Case 4. R.I. No. 48566. Gastro-ileal anastomosis.

A milkman, aged 63 years, had a partial gastrectomy of the Polya type performed in August, 1947, for a stenosing duodenal ulcer of eighteen years' standing, and complicated by five haematemeses.

On the fourth post-operative day he vomited 650 ml. of dark green fluid. A barium meal examination at this time showed the stoma to be functioning well. During convalescence the patient lost weight, suffered from vomiting, and had occasional bloodstained diarrhoea.

Three months after operation he was first seen in the Out-patient Department of the Radcliffe Infirmary and had obviously lost weight. General examination showed nothing abnormal, apart from internal and external haemorrhoids, which could have accounted for the rectal bleeding.

X-ray examination after a barium enema showed that the colon filled normally until the caecum was reached, but this was too irritable to retain the barium. Barium meal radiography showed the stomach remnant to be normal and the caecum to be irregular in outline, but no definite organic lesion was seen. There was no mention of the rate of passage of barium through the small gut before reaching the caecum.

The patient continued to vomit on occasions. The vomitus was usually clear, but occasionally showed brown discolouration. He continued to lose weight and he became disorientated.

He was admitted to hospital in December, 1947, when he was wasted and passing several loose, foul-smelling motions each day. His tongue was fissured and rather red, he was disorientated, showed a mild nystagmus, marked ataxia, incoordination, diminished reflexes and tender calves. The rectal mucosa was oedematous and hyperaemic.

Pathological investigations gave the following information: Red blood cells, 3,520,000; haemoglobin, 9.4 g.; white cells, 6,200; blood sedimentation rate, 20 mm. in one hour; blood-urea, 34 mg. per 100 ml.; plasma chloride, 629 mg.; cerebro-spinal fluid gave a negative Wasserman reaction, contained 50 mg. of protein per cent and showed 2 lymphocytes per high-power field. A diagnosis of Wernicke's encephalopathy was made.

A high vitamin, high protein diet was prescribed and an initial improvement was noticed; the bowel actions were reduced in number, but still remained frequent and very foul. A four-day fat balance test showed an 81 per cent absorption of fat. No further improvement followed and, although a definite diagnosis could not be reached, it was considered that an error in the anastomosis was likely.

At laparotomy by Mr. J. A. Shepherd in March, 1948, there was marked ascites and the stomach was found to have been anastomosed to the ileum about 40 cm. from the ileo-caecal junction. The anastomosis was undone and gastro-jejunostomy performed. The debilitated patient developed general peritonitis and died thirteen days later.

DISCUSSION.

An anastomosis of the stomach to the ileum and even to the colon is a rare but recognised technical error in gastro-enterostomy (Bockus, 1946).

Smith and Rivers (1943) state that there is approximately one case of gastro-ileal anastomosis diagnosed in each one to two years at the Mayo Clinic. In a series of 9 cases reported by these authors, diarrhoea was present in 6, and began within five days of the operation. They state that this point was useful in the differentiation from gastro-jejunocolic fistula, in which the onset of diarrhoea is always much later. Diarrhoea occurred only when the anastomosis was near the large bowel, and in these cases there was faecal belching.

Vomiting in gastro-ileal anastomosis may be of the retention type and occasionally has a faecal quality. Peripheral neuritis, oedema and other nutritional disturbances are commonly associated with this condition.

The case now reported is of interest in that, despite the proximity of the anastomosis to the large bowel, the onset of diarrhoea was later than usual. Neither faecal belching nor definite faecal vomiting occurred.

Loss of weight and diarrhoea associated with vitamin deficiency may occur after a well-performed partial gastrectomy. If, however, the nutritional disturbances are not relieved promptly by appropriate dietetic means, then the possibility of a faulty anastomosis in the form of a gastro-ileostomy should be considered.

Radiography may be of help if the possibility of a faulty anastomosis is kept in mind. In the case described above, the radiologist reported a healthy anastomosis, and although a little puzzled by the disposition of the efferent loop, the true explanation was missed. The important points to observe if such an error is suspected, are the mucosal pattern and course of the efferent loop, which is normally seen to run down the left side of the abdomen. In the case now reported, the efferent loop crossed to the right iliac fossa (Fig. III).

FIG. III. Barium meal radiograph in Case 3, showing efferent loop passing across abdomen to the right.

COMMENT.

The "three-quarter" partial gastrectomy performed on the first patient was followed by a perforation of an afferent loop jejunal ulcer, a complication which does not appear to have been previously reported. Closure of the perforation was difficult, but was followed by apparent cure for ten months. The decision as to whether or not further surgical treatment should be performed is an anxious one, because the catastrophe of perforation may be preceded by only slight symptoms. The absence of free acid after a test-meal may be only apparent and not real because of the wide stoma after a Polya type of anastomosis. When a partial gastrectomy is performed to cure a duodenal ulcer, especially in a young man, the most radical resection is necessary to prevent recurrent ulceration.

Orange pith impacted in the jejunum of the second patient after the large bolus had passed through the wide stoma and dilated upper jejunum. It is possible that a Hofmeister valve made at operation might have prevented this. Although the patient may be encouraged to take a normal diet after his operation, he should thoroughly masticate his food. The mechanism of the "dumping syndrome" is not yet adequately explained; this patient experienced late symptoms which were associated with hypoglycaemia and relieved by olive oil and restriction of fluids.

Jaundice and an epigastric tumour were found in the third patient four years after a partial gastrectomy. In investigating such a case accurate observation as to whether or not the afferent jejunal loop fills on barium meal radiography would be of great assistance in making a diagnosis of afferent loop obstruction.

The fourth patient lost his life because of a gross technical error. It is possible that he might have survived had this error been recognised and corrected earlier. The patient lived 6 months after a gastro-ileal anastomosis and died from peritonitis after the second operation. Even with prolonged preparation and particular care in suturing, it may not be possible to bring a debilitated patient of this type through a severe operation to ultimate recovery. The possibility of such a faulty anastomosis must be considered when a partial gastrectomy is followed by persistent diarrhoea, loss of weight and symptoms of vitamin deficiency. The mucosal pattern and course of the

efferent loop seen in barium meal radiography are important radiological aids in diagnosis.

Many authorities recommend the retrocolic Polya-Hofmeister procedure as the most satisfactory type of partial gastrectomy. They consider that the incidence of "dumping" is less when a valve has been made, and that there is less likelihood of other digestive upsets, and of jejunal ulceration, when a short retrocolic loop is used instead of a relatively long antecolic one. But there does not seem to be any conclusive evidence that this is so, and certainly the retrocolic operation has not been universally adopted.

The four complications now reported all followed antecolic anastomoses, in 3 cases without a valve. This is not necessarily significant because the antecolic anastomosis is used at present in almost all cases in the Radcliffe Infirmary, and in the majority a valve is not made. Results have been most satisfactory in the great majority of patients.

Both the antecolic and retrocolic operations, with or without a valve, have their own advantages and disadvantages, but excellent results are obtained in good hands by either method. Late complications following partial gastrectomy are uncommon, and only a large and carefully studied series of both types of operation performed by the same surgeon would entitle one to recommend the one operation before the other.

SUMMARY.

1. Four late complications of partial gastrectomy are described. The partial gastrectomies were all of the antecolic Polya type with anastomosis of the afferent loop to the lesser curve.

2. In the first of the cases described, partial gastrectomy was followed by perforation of a jejunal ulcer of the afferent loop. In the second case it was followed by "dumping" symptoms and then acute intestinal obstruction due to impaction of orange pith in the lower jejunum. In the third case partial gastrectomy was followed by obstruction of the afferent jejunal loop by adhesions; the distended loop was palpable as an epigastric tumour and the patient developed jaundice. In the fourth case the ileum was mistaken for the jejunum and was used in making the anastomosis.

ACKNOWLEDGEMENTS.

We are indebted to Mr. D. C. Corry, Mr. A. Elliot-Smith and Mr. J. A. Shepherd for permission to publish these cases, to Dr. F. H. Kemp for the radiographs, and to Mr. J. R. P. O'Brien for the biochemical estimations.

REFERENCES.

ALDERSBERG, D., and HAMMERSCLAG, E. (1947), *Surgery*, vol. 21, page 720.

ALLEN, A. W., and SMITHWICK, R. H. (1942), *New Eng. J. Med.*, vol. 226, page 864.

BAUMEISTER, C. F., and DARLING, D. F. (1947), *Ann. Surg.*, vol. 126, page 251.

BOCKUS, H. W. (1946), "Gastroenterology," vol. 1. Philadelphia and London: W. B. Saunders.

DELRIO, J. M. A., PAZ, R., and CARPANELLI, J. B. (1944), *Rev. Assoc. Med. Argent.*, vol. 58, page 232.

ELLIOTT, A. H. (1932), *Amer. J. Med. Sci.*, vol. 184, page 85.

IRVINE, W. T. (1948), *Brit. Med. J.*, vol. 2, page 514.

MARSHALL, S. F., and DEVINE, J. W. (1941), *Surg. Clin. N. Amer.*, vol. 21, page 743.

SEIFERT, E. (1930), *Deutsch. Ztschr., F. chir.*, vol. 224, page 96. Quoted by Elliott above.

SMITH, L. A., and RIVERS, A. B. (1943), *Surg. Gynec. Obst.*, vol. 76, page 110.

TOLAND, C. G., and THOMPSON, H. C. (1936), *Ann. Surg.*, vol. 104, page 827.

WARREN, K. W., and FALLIS, L. S. (1944), *Surgery*, vol. 15, page 569.

—— (1946), *Amer. J. Surg.*, vol. 72, page 4.

WILKIE, D. P. D. (1934), *Ann. Surg.*, vol. 99, page 401.

Books Reviewed.

EVOLUTION OF THE FOREBRAIN: The fundamental Anatomy of the Telencephalon, with special reference to that of Testudo geometrica.

By G. W. H. Schepers, D.Sc., M.D. Capetown: Maskew Miller Ltd., 1948. 11" x 8¼", 228 pp., with 250 illustrations. Price: 50s.

This book is primarily a careful and detailed description of the anatomy and function of the forebrain of a tortoise, Testudo geometrica, as indicated in its sub-title. With this work as a basis, the author has deduced homologies with other vertebrate brains and the human brain.

These general problems are more particularly discussed in the last five chapters. The above statement may serve to indicate the dividing line between the extremely detailed, careful and thorough description of every aspect of the brain of the tortoise given in the first eleven chapters, and the highly speculative and at times uncritical, even if stimulating, hypotheses put forward in the final five chapters. His studies on the cerebral cortex in the tortoise support the views of Dart, Shellshear, Abbie and others, upon what we may term the marginal evolution of the neopallium, from the hippocampal and pyriform cortex as particularly developed by Abbie in the monotremes and marsupials.

Many interesting suggestions are put forward as to the morphological problems on the distribution of neurone masses and their relation to blood vessels and nerve fibre masses.

The book is also very fully illustrated, though the figures are often extremely difficult to follow owing to the author not giving his lettering in alphabetical order, and also there is an irritating and excessive use of abbreviations.

Again in criticism it must be said that in the interpretations and hypotheses put forward particularly in the last few chapters all recent fundamental work on inhibitory strip areas and circuits in the cerebral cortex and basal ganglia, starting from Marion Hines (1934), Bucy, Fulton, McCulloch and others, has been neglected, while the work of Clinton Woolsey and Adrian and others on secondary cortical areas, motor, sensory, auditory and visual is not even referred to.

This book, therefore, while of fundamental value to any laboratory of comparative neurology, needs to be handled by an expert as regards its speculative chapters, for he alone can assess its virtues and its defects.

In conclusion we may mention one feature of fundamental importance which is contained in the short sentence in small print on the title page: "Produced by means of a grant from the South African Council for Scientific and Industrial Research." Both Dr. Schepers and South Africa are to be congratulated on the fact that they have a Scientific and Industrial Research Council broad-minded enough to help in the production of a work of this type, of value to fundamental research, but with what the practical man might think, only general value to the study of clinical neurology.

We hasten to add that we do not agree with the assessment of the practical man; at any moment ideas springing from a book such as this may develop some practical bearing.

MODERN PRACTICE IN ANAESTHESIA.

Edited by FRANKIS T. EVANS, M.B., B.S., F.F.A.R.C.S., D.A. London: Butterworth & Co. (Publishers) Ltd., 1949. 9½" x 6½", x plus 606 pp., with 227 illustrations and 1 colour plate. Price 65s.

In this volume 24 authors write 38 chapters covering various aspects of the subject of modern practice in anaesthesia. The result is a somewhat uneven presentation of the subject. Whilst some chapters are well written and fully discuss a subject, others are little more than catalogues of disjointed facts which do not make for easy reading. As the result of the form of presentation, some subjects are treated by several authors so that various opinions are stated without cross reference. This could produce considerable confusion in the mind of a reader unless he already possessed a wide knowledge of the subject.

An unfortunate feature of the volume is that it creates the impression that there are two forms of anaesthesia — old and new — and that these are mutually antagonistic. Some of the older writers condemn modern methods, whilst, by their own statements, they show a poor knowledge of the principles underlying them.

Most of the chapters are well illustrated. Line drawings have been used extensively rather than photographs, a fact which gives clarity to the illustrations.

Anaesthetists will find this volume a useful book of reference and surgeons will derive benefit from chapters on the pre-operative and post-operative care of the patient.

LORD LISTER—HIS LIFE AND DOCTRINE.

By DOUGLAS GUTHRIE. Edinburgh: E. & S. Livingstone Ltd., 1949. 9" x 6½", viii plus 128 pp., portrait and 20 plates. Price: 15s. net.

Dr. Douglas Guthrie has produced, within a small compass, a most admirable account of the life and work of Lord Lister. The author gives brief but adequate accounts of the state of surgical practice before Lister and traces the change that occurred with the adoption of Listerian principles.

New light is thrown on Lister's work by reference to previously unpublished autograph letters in the possession of the University of Edinburgh and the Royal College of Surgeons of England.

The book is very well produced with excellent illustrations.

THE FRONTAL LOBES.

RESEARCH PUBLICATIONS, Association for Research in Nervous and Mental Disease. Vol. XXVII. By various contributors, under an Editorial Board consisting of Professor John F. Fulton and Drs. Charles D. Aring and S. Bernard Wortis. Baltimore, U.S.A.: The Williams & Wilkins Co., 1948. 9" x 5½", 901 pp., with 237 illustrations, 39 tables. Price: £4 13s. 6d.

This monumental work represents the entire proceedings of the annual meeting of the Association for Research in Nervous and Mental Diseases, held in New York in December, 1947. The programme, which consisted of thirty-seven papers, had been planned to cover the anatomical, experimental and clinical studies of the frontal lobes, with special reference to frontal lobotomy. During the past fifteen years two very important methods of experimental approach to frontal localization have been developed, viz., the technique of physiological neuronography by Dusser de Barenne, and the application of the psycho-biological training techniques of Yerkes and colleagues to the higher primates, in combination with neurosurgery. The latter method enabled Carlyle Jacobsen and his associates to present the full details concerning the training and performances of those now famous chimpanzees, Becky and Lucy, both before and after frontal leucotomy, work which played an important part in inaugurating the operation on man and which forms the opening chapter of this remarkable book.

As pointed out in the preface by Professor John Fulton, it is estimated that 1,500,000 beds would be needed to accommodate in institutions all the psychiatric patients in the U.S.A. The reports from the larger series of lobotomies indicate that from 40 to 50 per cent of schizophrenics can be returned home after this operation, and that 50 per cent of these can be usefully employed. If only 20 per cent of all patients in mental institutions are schizophrenics and half of these could be sent home, it is estimated that nearly a million dollars a day could be saved to taxpayers. But these economic aspects of the operation are only of minor importance when compared with the opportunity thus afforded for obtaining basic information about the physiology of the brain and enlightenment on that problem of the ages, the mind-body relationship.

The book is divided into four parts, covering biological, experimental and clinical studies of the frontal lobes, and frontal lobotomy itself.

Part 1 opens with the remarkable paper already referred to, on the results of frontal lobe ablation in the chimpanzees, Becky and Lucy, studied over a period of three years. A short paper on the specialization of behavioural functions and the frontal lobes, by Professor Ward Halstead, deals with the ego and the frontal lobes and with four factors, the central integrative field factor, the abstraction factor, the power factor and the directional factor, as determined in a study of 237 patients (including 30 controls). From his results he was able to explain the prototype of the neurotic, chronically depressed, anxiety ridden mental patient so frequently met with to-day. After papers on the cyto-architecture of the frontal lobes in Primates and Man by von Bonin and Percival Bailey, with an interesting controversy on the relative merits of the Economo and Brodmann nomenclatures, there follows a very intensive study of the connections of the frontal lobes, especially with the thalamus, established by physiological neuronography. Lassek then gives some basic considerations of cortico-spinal neurons in the pyramidal tracts in which pleasing references are made to the work of the late A. W. Campbell, of Sydney, in 1905, with regard to the functions of the giant Betz cells which he numbered at only 25,000, a number which Lassek had placed at nearly 34,000. Fibres from these large Betz cells only represent 1:40 of all figures in the pyramidal tracts.

This paper leads logically to another by Mettler on the extensive system of non-pyramidal motor projections from the frontal cerebral cortex, with special reference to the adversive field and turning areas. Interference with these tracts and fibres was the cause of many of the signs previously allotted to the pyramidal tracts.

A very fascinating, though previously unknown, paper on the pathways and pathogenesis of cortical epilepsy is presented as a translation of the original by the Polish Professor Johann Prus, read at Lemberg in 1898. In it the author concludes that epilepsy is the result of extra-pyramidal stimulation. From careful experimental observations, he disproves Unverricht's theory on the conduction of cortical epilepsy along the surface of the brain according to a law of irradiation and postulates other ideas on epilepsy which are accepted to-day.

This part closes with articles on the thalamic projection to the frontal lobe, as proved by frontal lobotomy by Freeman and Watts (in which they infer that retrograde atrophy of the thalamus may be the important factor in the relief of mental disorder) and on the important connections between the orbito-frontal agranular cortex and the dorso-medial nucleus of the thalamus, on which the modified operation of transorbital frontal lobotomy is based by Freeman. Taking them as a whole, the papers in this part are rather too intricate and technical except for neuro-physiologists and experimentalists, although their conclusions often have far-reaching results.

Part 2 comprises 9 articles concerned with purely experimental studies on the frontal lobe. It is the largest part of the book and has some very important contributions. It begins with a remarkable paper by Denny Brown and Bottrell on the motor functions of the agranular frontal cortex, which occupies 111 pages.

Some forebrain mechanisms involved in the expression of rage and the suppression of angry behaviour are dealt with in a long and redundant paper by Bard and Mountcastle.

In one of the most important articles in the book Ward discusses the relationships between the anterior cingulate gyrus and personality. This region is often referred to as the anterior limbic area, the L.A. of Economo and area 24 of Brodmann. It receives afferents from the antero-medial nucleus of the thalamus. Stimulation produces autonomic responses, stoppage of respiration, vagal cardiac slowing and suppression of cortical actions, whereas ablations or destruction by neoplasm produce marked personality changes with loss of mentality and reasoning, the opposite to anxiety states, i.e., "and sometimes he just sits!" Injuries to this area may occur in lobotomy operations and

may account for the patient passing into a state of confusion and unresponsiveness. The results of section of its afferent and efferent fibres in a young female with hebephrenic schizophrenia are described, but the application of this operation is advocated to patients with obsessions and compulsions charged with fear. It is understood that this procedure is being carried out on a series of patients at Sir Hugh Cairns' clinic at Oxford, and their results should be extremely interesting.

Part 2 concludes with a well presented and carefully worked out paper by Earl Walker and Johnson on normal and pathological after-discharges from the frontal lobe.

Part 3 concerns itself with clinical studies of certain functions of the frontal lobes and of the effects of various frontal lobe lesions in man. It opens with one of the most practical articles in the book, in which Ackerley and Benton report in full detail the life history of a patient, then aged 35, with bilateral frontal lobe defects. These defects were actually seen at operation and were either due to congenital mal-development or to an injury when four years old.

A symposium on gyrectomy is presented in 3 parts by Penfield, Cameron and Prados and Malmo. The autonomic functions of the frontal lobes were studied by Netsky and Starr, with special reference to control over sweating, temperature of the skin, blood pressure, etc., in 50 war veterans suffering from wounds of the frontal lobes, and post-traumatic epilepsy. A full description with illustrations of an ingenious, but rather complicated instrument and apparatus for the performance of a standard bifrontal lobotomy is presented by Davidoff and Brenner.

The remaining two articles in this part and the whole of part 4 are devoted to the procedure of frontal lobotomy and its effects.

The whole book is presented in a very legible and clear manner, with excellently reproduced photographs, charts, etc. The text has been well edited and is singularly free of errors. Indeed, only one was noted, i.e., on page 577, where "the homolateral area of the opposite side" should probably read "the homologous area, etc."

At the end of each paper any discussion which took place and any questions which were asked are recorded along with the author's replies; considerable interest is thereby added to the conclusions reached. A full list of all contributors, with their titles and qualifications, is given at the beginning of the book in alphabetical order. As well as a very complete index, a cumulative bibliography of the references given in all the articles has been prepared and should be very valuable to anyone wishing to pursue the many intricate subject-matters further.

Finally, a complete list of the names and addresses of the 560 odd members of the Association (many of them household words in neurology and psychiatry) forms a fitting ending to such an impressive work, which needs to be "read, marked, learnt and inwardly digested" by all those concerned with the interpretation of lesions of the frontal lobes.

THE SURGICAL TREATMENT OF FACIAL INJURIES.

By VARAZTAD HOVHANNES KAZANJIAN, M.D., D.M.D., and JOHN MARQUIS CONVERSE, M.D. Baltimore, U.S.A.: The Williams & Wilkins Co., 1949. (Sent by Angus & Robertson Ltd., Sydney.) 10" x 6¾", xiv plus 574 pp., 746 figures. Price: £5 7s. 6d.

Principles and procedures in the treatment of facial injuries have been fairly well established for many years. It is not always realised that such procedures as forehead rhinoplasty were described hundreds of years ago. Technique and detail has, however, been modified and improved so that the present standard of end results is far higher than that of thirty years ago. Kazanjian and Converse have produced a volume which contains a sound expression of present day thought and experience in the many problems involved in facial repair, as seen from the stand point of the plastic surgeon. The influence of war on the development of the surgery of injuries is a mighty one. The senior author had an extensive experience in the treatment of face and jaw injuries in the first world war. The second author has had great experience in the second world war, and worked in 1940-41 in association with, and under the direction of Sir Harold Gillies, the acknowledged leader of plastic surgery in England, for a long period. This powerful influence is evident throughout the book and would justify some more specific acknowledgment than is apparent in the introduction and text. The authors have produced a book which should be of great value to any student of the surgery of repair. They have steered a happy course between the brief summary of procedure on the one hand, and on the other hand the vast tome which attempts to describe all possible methods without a sense of preference or perspective. Most of the procedures described here have stood the test of time and are the best available. Sometimes the authors have fallen into the so common fault of describing theoretical procedures which they would not themselves adopt and which indeed are not used by anyone of experience. For the most part the principles and detail are sound and well presented, errors are few, illustrations are good, and the volume is one of the best so far produced on this subject.

HEARING TESTS AND HEARING INSTRUMENTS.

By LELAND A. WATSON and THOMAS TOLAN, M.D. Baltimore, U.S.A.: The Williams & Wilkins Co., 1949. (Sent by Angus & Robertson Ltd., Sydney.) 9" x 5¾", 597 pp., 239 illustrations, 23 tables. Price: £3 15s. 3d.

This book, a first edition, breaks new ground in the field of medical electro-acoustics and is probably the most detailed reference book available in this branch of otology. A complete survey of the whole field of audiometry, hearing tests and hearing aids, is given in lucid text and lavish illustration. Although primarily a book for the technician, it is one which contains much invaluable information for the practicing otologist. The first eight chapters are concerned with audiometry—the technique, the evaluation of the results, audiometric studies as an aid to diagnosis, the care of the audiometer and, finally, the design and manufacture of audiometers.

Malingering tests for feigned deafness are covered very fully, and chapters on the social aspect of deafness, and school hearing tests and problems

are similarly dealt with. One hundred and fifty pages are devoted to a description of the modern hearing aid and the prescription and fitting of hearing aids, and the work concludes with a discussion on the social and economic aspect of hearing aids and speech hearing tests.

For the advanced worker there is a large section on advanced audiometry research, and the excellent bibliography, of 47 pages, greatly adds to the value of the work as a whole.

For those interested in hearing aids and audiometers, this book provides much accurate and detailed information. For those interested in acoustic trauma and hearing losses of industrial origin, in reduction of noise in industry, and in assessment of hearing disability for insurance compensation, it provides a mine of valuable information.

ANKYLOSING SPONDYLITIS.

By F. HERNAMAN-JOHNSON, M.D., F.F.R., D.M.R.E., and W. ALEXANDER LAW, O.B.E., M.D., F.R.C.S. London: Butterworth & Co. (Publishers) Ltd., 1949. (Sent by Butterworth & Co. (Australia) Ltd., Sydney). 8½" x 5¼", viii plus 200 pp., 41 figures. Price: 34s.

These authors—one a physician and the other an orthopaedic surgeon—have dealt with the medical and orthopaedic aspects of this disease in a very complete manner. The former acknowledges his debt to the late Dr. Gilbert Scott who wrote his book in 1942; and the latter to Dr. Smith-Petersen whose operations on the hip and the correction of spinal deformity by osteotomy of the spine are described very fully. The subject as a whole is fairly and completely covered; and the book should be a very useful one.

THÉORIE ET PRATIQUE DE L'OSTÉOSYNTHÈSE.

By ROBERT DANIS. Paris: Masson et Cie, 1949. 9¾" x 6½". 298 pp., 274 figures. Price: 1100 fr.

This book is a systematic study of the various methods of internal fixation for fractures; is a guide to the various indications and contra-indications for operating; and in each section, gives the results of treatment of the fractures, of which 1,500 have been studied. There are numerous good illustrations and the description of operations and their difficulties are clearly and fully described. There are pictures of all the special instruments used by the author. It should be a very helpful book for any surgeon wishing to have some authority to read before engaging upon these operations.

LA CHIRURGIE DE LA DOULEUR.

By RENE LERICHE. Third Edition. Paris: Masson et Cie, 1949. 472 pp. 9¾" x 6½". Price: 1,450 fr.

This is the third edition of a stimulating and provocative book on the subject of pain. Leriche has devoted almost a lifetime to the study of pain as an entity in itself. He has little patience with doctors who complacently assert that pain is a defence mechanism, a warning, but maintains that the majority of the gravest diseases commence quietly and progress insidiously, and that it is only in the late stages that pain is a feature.

"There is only one pain which it is easy to suffer and that is the pain of others."

Leriche is convinced that in these scientific days doctors are too prone to stand by and watch the sufferings of a fellow human and vie with one another in abstruse explanations without making any attempt to offer relief. Because the doctor cannot fit the pain into a definite pattern and thus work out its cause, is no reason why he should call it functional and do nothing to alleviate it.

It is impossible to summarise the mass of clinical and experimental detail compressed within this closely printed volume of 472 pages. As in previous editions the author's views on the intimate relation of the sympathetic system to certain painful conditions is stressed. The pains of ischaemia (vaso-constriction) are emphasised. Migraine is included in this group and evidence presented from the study of clinical material. The subject of painful stump, phantom limb and similar intractable pain is discussed at some length, but the conclusions are disappointing.

The author is pessimistic as to results of treatment, Vitamin B_1, radiotherapy, novocaine injection of sympathetic ganglion, and maybe ganglionectomy are all advised.

He prefers posterior rhizotomy to cordotomy and myelotomy and favourably views frontal leucotomy in certain cases. Prophylaxis consists in injection of the cut nerve with novocaine, phenol and then ligation. In the treatment of causalgia nothing new is offered. An excellent review of the literature of this subject is given.

Suitable cases of angina pectoris are treated by stellate ganglionectomy through an anterior incision and unilateral operation often suffices. Other methods such as posterior rhizotomy are discussed but not favoured. Not all surgeons would agree that adrenalectomy is a necessary accompaniment of sympathetic ganglionectomy in the treatment of Buerger's Disease. Arteriectomy is favoured as an adjunct to sympathectomy. Leriche prefers root section to alcohol injection of the ganglion in cases of trigeminal neuralgia. He apparently has not practised injection methods. Ill-defined facial neuralgias are apparently as difficult to Leriche as to other surgeons.

The sections of the book dealing with bone conditions and visceral pains are controversial. Mackenzie's theory of referred pain is rejected. There is much that is provocative and there is a candid admission of ignorance on many problems which are generally regarded as solved. A small chapter deals with psycho-therapy and its occasional miraculous results in France.

The book can be recommended to the discriminating reader.

INDUSTRIAL TOXICOLOGY.

By LAWRENCE T. FAIRHALL. Baltimore, U.S.A.: The Williams & Wilkins Co., 1949 (sent by Angus & Robertson Ltd., Sydney). xi plus 483 pp., 11 tables. 9" x 5¾". Price: 64s. 6d.

"Industrial Toxicology," by Lawrence T. Fairhall, who is chief of the Industrial Hygiene Laboratory, Baltimore, is a reference manual dealing with poisonous substances met with in industry. The recognition of occupation as an important factor in many diseases is comparatively new in medicine and a considerable amount of information has accumulated in recent years about toxic substances in industry. This information is scattered through a wide

range of literature which the author set himself to survey. The fruits of his reading he has made available in this volume where he has brought together a great deal of useful information about many lesser known poisonous substances as well as those more generally known.

The book is essentially a reference manual in which the author describes the characteristics, industrial uses, toxicity and methods of analysis of over two hundred substances. No attempt has been made to classify these toxic substances into groups depending upon similar properties, but the author has simply divided them all into two groups, inorganic substances and carbon compounds. Each group he has arranged in alphabetical order. There is much to commend this simplicity.

Details of analysis are not included with each substance—the standard methods of analysis are indicated. At the end of the discussion on each substance a useful list of references is given. Not everyone will agree that arsenic is normally found in the human body, for numerous routine analyses of organs carried out by the forensic pathologist fail to detect it. However the author has placed the word normal in quotation marks.

One of the chief merits of this book is that it presents a great deal of useful material briefly and clearly in summary form, so that those whose work brings them in contact with the poisonous substances of industry will find summarised for them the chief points of interest and useful references which will save a great deal of searching through the literature for information not always readily obtainable.

It is a very useful manual not only for the industrial hygienist but for the pathologist and forensic scientist.

TEXT BOOK OF SURGERY.

By PATRICK KIELY, B.Sc., M.D., M.Ch.(N.U.I.), F.R.C.S.(Eng.) London: H. K. Lewis & Co. Ltd., 1949. vii plus 1,184 pp., 611 illus. 9¼" x 5¾". Price: 45s. net.

The preparation and publication of a text-book of surgery is a great task which few are disposed to undertake even when times and circumstances are favourable. Further, the existing text-books in the English language are mostly of such high standard that their popularity is not likely to be lost to a new publication, unless this manages to present the subject in a more modern and more acceptable manner. In commending Kiely for his industry and enthusiasm, it is not unfair to comment that this volume follows closely the conventional presentation of the subject and that it does not outshine its established rivals. One of the most disappointing features is the poor quality of the line drawings and photographs, many of which have no teaching value and some—e.g. that of Pagets' disease of the nipple on page 171—would be better omitted.

Throughout the volume, the author gives evidence of his wide personal experience as a general surgeon who has not become too highly specialised, and some of his remarks in his preface are most commendable. He has shown marked restraint in avoiding any tendency to delve into details of treatment, since this could only be achieved at the expense of space required for the principles of surgery and for surgical pathology. However, as the volume was published in 1949, the author could have introduced some reference to streptomycin and the newer antibiotics.

A number of the X-Ray reproductions are of poor definition,—e.g. those on page 671 and page 673—these are of no value in this class of book unless they are clear and typical. On page 711, referring to the treatment of acute intussusception in infants, the author remarks that "the outlook after this method in a child (i.e. proximal open drainage) is probably almost as gloomy as after either of the other methods" (i.e. resection of the entire mass or resection of the intussusceptum). The method of reduction by hydrostatic pressure is so well established and the results are so good, that the author could safely include some reference to it.

In contrast to a reasonably full section on cleft palate and hare lip, is a very limited reference to carcinoma of the lip. In the section on diseases of the lips, the reader is referred "elsewhere"—i.e. to an earlier section in which cancer is discussed as a subject, but there is a minimum of information even there; there is no discussion on differential diagnosis, or early diagnosis, and the clay pipe is still given precedence over the effects of sunlight as an important factor in the development of these lesions.

Defects, examples of which have been mentioned, together with the failure to achieve a new presentation, detract from the value of this book which can hardly be expected to displace the firmly established favourites in this field.

THE PATHOLOGY OF ARTICULAR AND SPINAL DISEASES.

By DOUGLAS H. COLLINS, O.B.E., M.D.(Liverpl.). London: Edward Arnold & Co., 1949. viii plus 331 pp., 199 figures. 9" x 5¾". Price: 35s.

In this book the author states he has sought to provide an up-to-date and adequately illustrated account of the morbid anatomy of the joints and the spine. In this aim he has succeeded admirably.

There is no doubt that the pathology of the skeletal system has not received the same attention in the past which has been given to the soft tissues. Most of the standard text-books set forth ideas which have not changed for many years. The clinician has tended to concentrate upon the radiological findings and the study of bone, and joint disease has too often been centred on the radiological findings, with neglect to study the actual pathological specimens either in post mortem room or in the histological laboratory.

The author has therefore given a maximum number of excellent illustrations of pathological specimens and microscopical preparations. The subject matter has been carefully arranged.

The introductory chapters deal with the anatomy and physiology of the joint—tissues and bone. As frequent reference has to be made to disease of bone a short survey of bone pathology has been given. It is really a very excellent summary of our present knowledge. Thereafter the arrangement follows an orderly pathological sequence.

The author has given a masterly account of the pathological changes found in rheumatoid arthritis

and rheumatic fever. He has not shirked from speculating upon a common etiology; all relevant evidence is carefully weighed.

The spine is very well done. The account of the pathological changes occuring in the intervertebral discs is particularly good. The author convincingly describes the clinical syndromes which follow on from disturbance of these structures; the adolescent and senile round back deformity.

The marginal osteophytes are shown to be due to disc displacement and not to osteoarthritis as has commonly been thought.

A feature of the work is the excellent bibliography given at the end of each section. This should facilitate further study in any particular subject. The book itself is well produced and amply illustrated. The style of writing is good with the result that the book is very readable.

The work breaks new ground and is obviously written by one who is intensely interested in, and has made a special study of the subject. It should have a wide appeal with especial interest to the pathologist, the orthopaedic surgeon, the physician who has to deal with rheumatic disease and lastly to the radiologist.

INJURIES OF THE BRAIN AND SPINAL CORD AND THEIR COVERINGS.

Edited by SAMUEL BROCK, M.D., with 28 Contributors. Third Edition. Baltimore, U.S.A.: The Williams & Wilkins Co., 1949. 9" x 5¾", xi plus 783 pp., 125 figures. Price: £5 7s. 6d.
(Sent by Angus & Robertson Ltd., Sydney.)

The 3rd edition of this monograph has been extended to 783 pages, representing an increase of more than 150 pages over the 2nd edition. It suffers from the disability of attempting to include in a single volume, all aspects of a subject which has been extraordinarily extended, partly by experience obtained during the last war, and partly by the introduction of new specialised techniques. The monograph, therefore, is of chief value as a general survey which directs attention to extensive bibliographies on particular subjects.

The balance of the subject matter represented may be questioned both by the student and the experienced neuro-surgeon. Disproportionate attention is paid to certain aspects of cranial and spinal injuries, which may either have no immediate practical bearing, or fall into the field of interest primarily of the pathologist or the psychiatrist. One is impressed on reading through the text by the emphasis placed, for instance, on malingering, psychosis, and medico-legal implications, while the merit of including a chapter of 30 pages on general pathological considerations in brain injury does not appear obvious at first sight, particularly when it includes many such naive statements as. " . . . A fairly common vascular change is congestion of the veins and capillaries."

An attempt is made in the chapter on the electroencephalogram in cases of head injury to summarise findings statistically by patients or percentages, an approach which would be called into question at least by the English School of electroencephalographers.

By far the most interesting and thoughtful chapter is that written by Sir Charles Symonds on concussion and contusion of the brain, and their sequelae.

The book is richly illustrated, and has considerable merit as a reference work.

Books Received.

CHIRURGIE DE L'URETRE.

By L. SABADINI. Paris: Masson et Cie, 1949. 376 pp., 411 figures. 10¼" x 7¼". Price: 2,500 fr.

CHOC TRAUMATIQUE—Étude Clinique, physiopathologique Therapeutique.

By J. CREYSSEL and P. SUIRE. Preface by Prof. R. LERICHE. Second Edition. Paris: Masson et Cie, 1949. 340 pp. 9¾" x 6½". Price: 950 fr.

LE CURARE EN ANESTHÉSIE. . . . . . .

By FRNEST KERN Preface by Prof. R. MERLE D'AUBIGNE. Paris: Masson et Cie, 1950. 124 pp., 6 figures. 7½" x 5½." Price: 300 fr.

ASPECTS ACTUELS DE L'ANESTHÉSIOLOGIE.

By MARCEL J. DALLEMAGNE. Paris: Masson et Cie, 1948. 462 pp., 71 figures. 9¾" x 6¼". Price: 1,650 fr.

SURGERY FOR NURSES.

By JAMES MORONEY, M.B., Ch.B., F.R.C.S.(Eng.), L.R.C.P.(Lond.). With a Foreword by Miss DOROTHY M. SMITH, O.B.E. Edinburgh: E. & S. Livingstone Ltd., 1950. xii plus 644 pp., 563 figures. 8½" x 5½". Price: 21s. 6d. net.

THE DEEP CERVICAL FASCIA. A Study in Structural, Functional and Applied Anatomy.

By E. S. MEYERS, M.B., F.R.A.C.S. Brisbane: The University of Queensland Press, 1950. 8½" x 5½", 39 pp., 18 illustrations. Price not stated.

HANDBOOK OF OBSTETRICS AND DIAGNOSTIC GYNAECOLOGY.

By LEO DOYLE, M.S., M.D. Illustrations by RALPH SWEET. First Edition. California, U.S.A.: University Medical Publishers, 1950. 7" x 4", 240 pp., 45 illustrations. Price: $2.00.

EMERGENCY SURGERY. Part III.

By HAMILTON BAILEY, F.R.C.S.(Eng.), F.A.C.S., F.I.C.S., F.R.S.E., asstd. by NORMAN M. MATHESON, M.B., Ch.B., M.R.C.P.(Lond.), F.R.C.S.(Eng.), F.A.C.S. Sixth Edition. Bristol: John Wright & Sons Ltd., 1950. 6½" x 10". iv plus 168 pp., 247 illustrations, many coloured. Price: 21/- per part.

CORRECTION.

In the article by G. H. BURNELL and J. MAYO entitled "Removal of the scapula for sarcoma, with retention of the arm" which appeared in Volume XIX, page 263, a correction should be made to the result of the serum alkaline phosphatase test on page 263. The result should read 41.6 units instead of 4.1 units.